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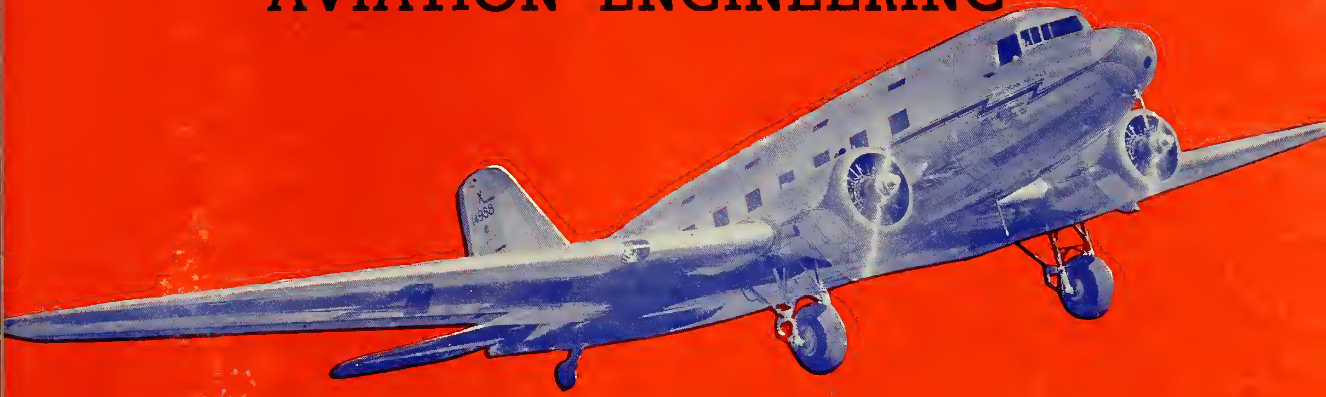
AERO DIGEST

INCLUDING

AVIATION ENGINEERING



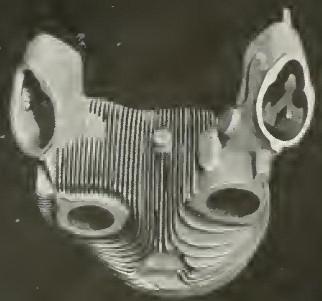
DIGEST OF

AIRCRAFT & ENGINE

MACHINERY

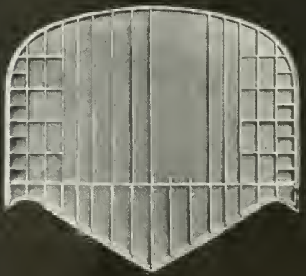
uary 1936

CENTS ★



Improved engine performance results from close fin spacing made possible by advances in foundry practice.

Greater use of extruded shapes is resulting in measurable economies.



The type of assembly on which new spot-welding developments will save money.

An example of parts now being formed from strong alloys without heat treating by the aircraft manufacturer.

THERE IS JUST ONE REASON *for the increasing use of* ALUMINUM

The increasing use of Aluminum, by more builders in more parts of the ship, is a reflection of the emphasis we have put upon product developments and process developments which would directly benefit the aircraft industry.

We feel a definite professional obligation to the aircraft industry. Nature made Aluminum light; it is *our* responsibility to do everything possible to make that lightness help achieve the industry's basic objective: lower cost per passenger-mile with safety and reliability.

With magnificent co-operation from the industry itself, that work is going forward on three distinct fronts: (1) Alloy development, such as 24S and 52S; (2) Improvement in manufacturing techniques, such as the recent forging and sand-casting developments; (3) Improvement of fabrication techniques, in the aircraft factory itself, to obtain greater economies.

These developments are resulting in major economies for many builders, and in lessened maintenance for many operators. If you are not as yet taking advantage of these developments, perhaps it is because we have not had the opportunity of laying all the facts before you. We would welcome that privilege. ALUMINUM COMPANY OF AMERICA, 2194 Gulf Building, Pittsburgh, Pa.

ALCOA · ALUMINUM

AERO DIGEST, *January*, 1936
Volume 28 *Number* 1

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HOUSTON PUBLIC LIBRARY
HOUSTON, TEXAS

Oxide-Free Tubing!

FOUR years ago government aircraft materials supervisors demanded scale free normalized aircraft tubing. Practice was modified in all tube mills to reduce scale incident to normalizing.

Summerill has gone one step further and is now producing an *oxide-free* surface on its normalized aircraft tubing. This tubing, while having no cold work following normalizing, has a bright finish, somewhat characteristic of cold finished steel.

The advantages of an oxide-free surface are:

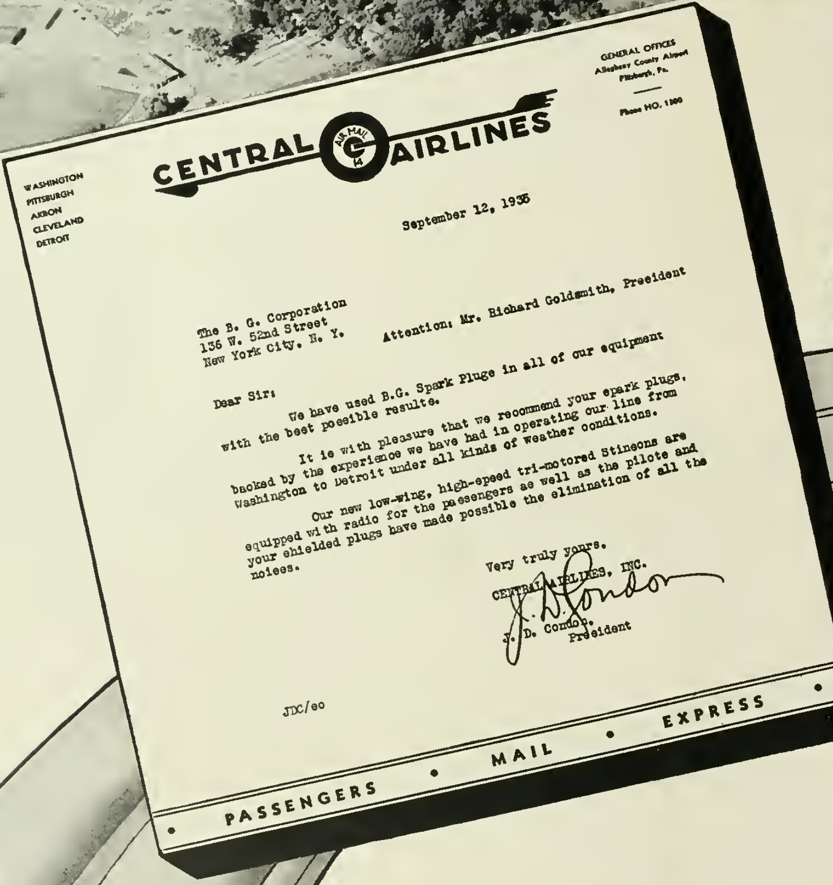
- » Surface imperfections are more readily detected.
- » The inspectors of the welded assembly can immediately detect wherever the torch has been applied.
- » It reduces oxide contamination at the weld.
- » It saves the expense of sand-blasting to achieve the same results.
- » It is cleaner and nicer to handle.

Summerill normalized oxide-free aircraft tubing "looks good" and is ***just as good as it looks.***

SUMMERILL TUBING COMPANY
SPECIALISTS IN TUBING SPECIALTIES
BRIDGEPORT, MONTG. CO., PENNSYLVANIA

CENTRAL AIRLINER

OVER PUT-IN-BAY, NEAR SANDUSKY, OHIO
ADMIRAL OLIVER PERRY, MONUMENT



CENTRAL AIRLINES
AIR MAIL 14

WASHINGTON
PITTSBURGH
AKRON
CLEVELAND
DETROIT

GENERAL OFFICES
Allegheny County Airport
Pittsburgh, Pa.

Phone HO. 1300

September 12, 1935

The B. G. Corporation
136 W. 52nd Street
New York City, N. Y.

Attention: Mr. Richard Goldsmith, President

Dear Sir:

We have used B.G. Spark Plugs in all of our equipment with the best possible results.

It is with pleasure that we recommend your spark plugs, backed by the experience we have had in operating our line from Washington to Detroit under all kinds of weather conditions.

Our new low-wing, high-speed tri-motored Stinsons are equipped with radio for the passengers as well as the pilots and your shielded plugs have made possible the elimination of all the noises.

Very truly yours,
CENTRAL AIRLINES, INC.
J. D. Condon
J. D. Condon, President

JDC/eo

PASSENGERS • MAIL • EXPRESS

BG

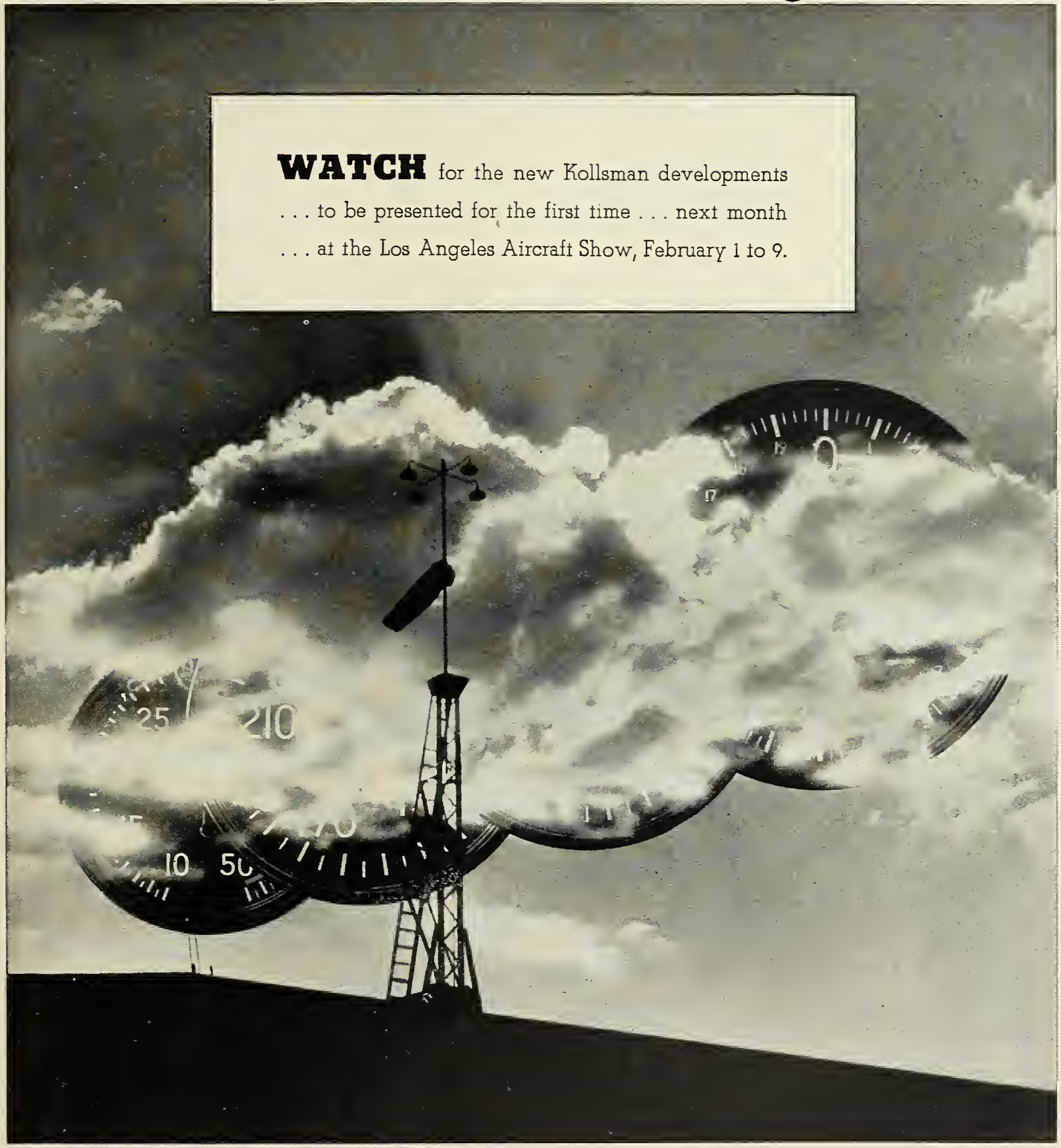
THE B. G. CORPORATION

Contractors to the United States Army and Navy and Aircraft Engine Builders

136 W. 52nd ST., NEW YORK

Cable Address: Golsteco, New York

KOLLSMAN FOR PRECISION



WATCH for the new Kollsman developments
. . . to be presented for the first time . . . next month
. . . at the Los Angeles Aircraft Show, February 1 to 9.

KOLLSMAN PRECISION AIRCRAFT INSTRUMENTS

KOLLSMAN INSTRUMENT COMPANY, 5 JUNIUS STREET, BROOKLYN, NEW YORK
WESTERN BRANCH, 1224 Airway, Glendale, California
EUROPEAN DIRECTOR: Com. M. Calderara, 47, Av. de Brimont, Chatou (S. & O.) France

ALTIMETERS • SENSITIVE ALTIMETERS • COMPASSES • NAVIGATION COMPASSES • NAVY STANDARD COMPASSES • AIR SPEED INDICATORS • LEVEL FLIGHT INDICATORS • TACHOMETERS
ICE WARNING INDICATORS • ENGINE GAGE UNITS • MANIFOLD PRESSURE GAGES • FUEL QUANTITY GAGES • OIL, WATER AND CABIN THERMOMETERS • VERTICAL SPEED INDICATORS

ANNOUNCING
THE NEW DOUGLAS SLEEPER

THE makers of the internationally famous Douglas Transport now present a new mode of transportation—royally appointed for night and day travel, and harnassing tremendous speed to the most modern flight-security developments.

Sleeping compartments provide privacy for sixteen, with day accommodations for twenty-four; there are separate dressing rooms and lavatories, a complete galley, and a pilots' compartment equipped with every aid to aerial navigation.

As companion to the world-accepted Douglas Transport, this Douglas Sleeper becomes the Aristocrat of the Airways. Douglas Aircraft Company, Inc., Santa Monica, California.

● *First Public Showing of the Douglas Sleeper—Aircraft Show, Los Angeles, February 1 to 9.*

DOUGLAS . . . FIRST AROUND THE WORLD

WHEREVER YOU GO. YOU CAN TRAVEL VIA LUXURIOUS DOUGLAS EQUIPMENT
IN AMERICA on American Airlines, Eastern Air Lines, Pan American Airways, and T. W. A., Inc.
IN SOUTH AMERICA on Pan American Grace Airways.
IN EUROPE—OELAG in Austria; Deutsche Lufthansa in Germany; K.L.M. in the Netherlands; L.A.P.E. in Spain; LOT in Poland; Avio Linee Italiane in Italy; and Swissair in Switzerland.
IN THE ORIENT on Japan Air Transport, China National Aviation Corporation, and K.N.I.L.M. in the Netherlands Indies.

THIS is the first of a series of advertisements to appear in TIME Magazine beginning January 13.

Train for ACHIEVEMENT *in* AVIATION

● ● ● Only men of proven ability can be entrusted with the maintenance and operation of such giants of the air as this Clipper which blazed the Pacific air trail for Pan American Airways. That is why Pan American Airways has already selected many men who secured their training at Parks Air College.

● A CAREER . . . OR JUST A JOB?

If you want only a job in aviation, you will not be interested in this announcement.

But, if you look on your first job as just an entry into aviation . . . if you can visualize yourself advancing to more and more responsible positions . . . if you anticipate riding great airliners back and forth across the continent, over the oceans and around the world in the service of aviation . . . if you expect to make valuable contributions to the delevopment of transportation by air, and so win recognition and rewards for yourself . . .

Then read on. You will be interested.

For this message is about Parks training . . . training that will take you far beyond your first job . . . that will enable you to realize your ambitions.

● GRADUATES ARE ADVANCING

Parks training will do for you what it is doing now for hundreds of graduates who are with such companies as Transcontinental and Western Air, American Airlines, Eastern Airlines, Pan American Airways, Pratt and Whitney Aircraft Company, Fairchild Aircraft Corporation, Lockheed Aircraft Corporation, Sikorsky Aircraft Corporation, Douglas Aircraft Company, Curtiss-Wright Airplane Company, Beech Aircraft Company, and many others.

One of these graduates who is with a major airline, wrote to Oliver L. Parks, President of Parks Air College, under date of November 2, 1935:

> "I am very glad to tell you I received a nice raise today. I will quote what our Personnel Director wrote me. He said: 'I want to congratulate you on your increased salary which has resulted from the excellent character of your work for the company, and I wish you continued success and advancement.'"

Another graduate wrote:

> "I got a real thrill this evening when I had dinner with our Superintendent. He said I was going to go a long ways with this Company and that I am already in line for a substantial increase in salary."

Similiar letters from graduates are received daily.

● 8 YEARS OF LEADERSHIP

Back of the success of Parks graduates is training, practical and thorough, which has been built up by Parks Air College during eight years of leadership in providing aeronautical education and training.

Whether you select the Piloting, Executive, Engineering or Maintenance field in aviation, Parks Air College offers you a course of training which will assure you, when you have completed it with a good record, of gratifying success. It will make you a preferred man in aviation, create a demand for your services, and open up the way for the promotion and salary increases you desire.

● THE CATALOG IS FREE

Since you want such a career for yourself in aviation, send now for the Parks Air College catalog and bulletin. These books will tell you all about the School and the training which have already meant success for hundreds of graduates and can mean as much for you.

The coupon will bring these books to you. Fill it in and mail today . . . NOW!

Spring term opens March 30th

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

●

Accredited by the Illinois Superintendent of Public Instruction.

PARKS AIR COLLEGE
WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 1 AD

EAST ST. LOUIS, ILL.

Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name____________________ Age______

Address ____________________

City____________________ State______

CHECK HERE
for special information on the course that interests you:

- ☐ Executive Transport Pilots'
- ☐ Aeronautical Engineering
- ☐ Master Mechanics' Flight
- ☐ Executive Course

TROPHIES FOR SPEED AND PERFORMANCE

"...and so Easy to Fly!"

*Says Arlene Davis**: "I thought you might be interested to know after flying my cabin airplane, and being only a private pilot, my husband presented me with a new Beechcraft. I was somewhat concerned as to whether I could fly the Beechcraft, but I find it is the easiest plane to fly I have ever piloted, including my previous plane . . . . . Thanks to you for the simple and marvelous performance you have been able to obtain."

Charlotte Frye autographs her photograph with these remarks: "I sincerely wish all pilots knew the ease of maneuvering a Beechcraft! Beauty and speed speak for themselves. With pride, this is my ship."

*Winner of the 50 mile handicap in the 1934 Women's National Air Races.

I sincerely wish all pilots knew the ease of
maneuvering a Beechcraft. Beauty and speed
speak for themselves. With pride, "This is my ship."
Charlotte Frye

Beechcraft is famous for its high cruising speed and sensational performance. But Arlene Davis and Mrs. Frye have discovered to their great pleasure and surprise that Beechcraft is *also* remarkably easy to fly.

THE
BEECH AIRCRAFT CO.
Wichita, Kansas

BEECHCRAFT

The Birdmen's Perch

Airmen, this is your page. Use it to find out about old friends, to pass on gossip, to have your say-so about the industry. *The space is yours—to do with as you wish.* Contributions, suggestions and criticisms will be welcomed. Address all correspondence to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Refining Company, Pittsburgh, Pa.

"DOES anybody know the whereabouts of Charles Augustus Macatee III?

"Charlie was a dead ringer for a certain famous flier with a pretty similar name. Every time he landed at an airport, crowds used to collect and whoop it up.

"Charlie was a smart airman in his own right. He invented and installed the first traffic lights at any flying field, and I guess he got fed up with being taken for another flier and disappeared.

"Recently I heard that he was a pilot for an eastern airline. Can anyone tell me whether this is true?

"Incidentally, your Gulf Aviation Gasoline is the finest fuel I ever put in a tank." —J. S.

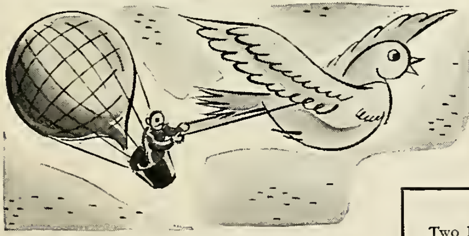
"Let's get the PWA boys busy taking down all overhead wires around airports. They're a menace and they certainly ought to be buried underground." —R. R.

LOST!

At the Cleveland Municipal Airport: a pair of hand-knitted mittens. On the inside of the mittens are stitched these words: "With love, Emma." Emma thinks that I lost them on purpose, and is not speaking to me.—Q. V. C.

DID YOU KNOW?

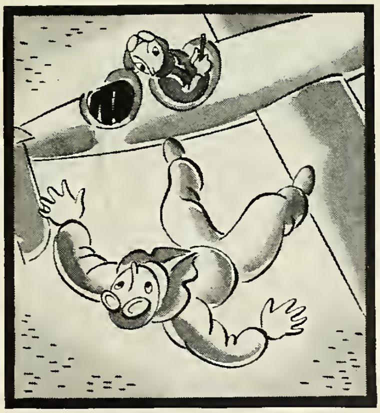
That a German inventor worked out and, in 1899, patented designs for a balloon to be drawn by pigeons.



That the patron saint of the Caterpillar Club should be one Fauste Veranzio, who jumped from the top of a high tower in Venice in 1617, wearing a harness connected with a canvas-covered framework. Signor Veranzio survived.

That the first cross country flight from the Atlantic to the Pacific was made by C. P. Rodger in a Wright biplane in 1911, with many stops, and took 49 days.

That the World's Best Oil for Airplane Motors is Gulf's Alchlor-processed *Gulfpride*, which forms only one-fifth the carbon of the next best oil made.



ARE WE BEING SPOOFED?

"I am told that several years ago at a county fair in the middle west a pilot was doing some stunt flying and was thrown from the plane while making a loop. His passenger, who had never flown before, grabbed the stick, did some plain and fancy experimenting with the controls, and finally brought the ship safely to earth.

"Can anyone verify this story for me, or is it a yarn?"—H. G.

FOUND!

Two New Champions at 1935 National Air Races: *Gulf Aviation Gasoline and Gulfpride Motor Oil.* Harold Neuman, Thompson Trophy winner, and Bennie Howard, leader in the Bendix Trophy race, piloted planes fueled by this marvelous gas and lubricated with this amazing oil. This is the first time any refining company has so outdistanced the field in these two extremely important races.

THIS MONTH'S WHOPPER

"Last week on one of my regular hops from Chicago to Kansas City, one of the passengers complained that we did not serve enough butter with her meal.

"The stewardess told me about it, so I pulled the ship down low and headed for a pasture.

"The cows there started running and I chased them round and round the field. I finally got them going in circles, then spinning like a top. After about an hour I quit chasing them and landed.

"Then I started milking one, and sure enough, I got butter instead of milk. I'd churned the milk by chasing them.

"I brought back a good pound of butter to the lady, but she wouldn't eat it because she liked only Guernsey butter and these cows were Holsteins.

"On top of that, she reported me to the company.

"Now I am milking cows for a living." —Former Pilot

The above reminds me that Pilot K. C. V. says that after 100 flying hours in an engine, *Gulfpride* motor oil is still so clean that you could spread it on bread and eat it. It is the only oil, he says, that he has ever found so clean.

"Boy, some pumpernickel!"

GULF REFINING COMPANY

GULF

refiners of fine aviation products

Dallas Aviation School and Air College

Wasp-Stearman

Just one of our mighty fine *training* ships. 450 H.P. Wasp motor—electric starter. Equipped for radio beam and blind flying. A $20,000 ship. The kind of an airplane all good pilots approve.

Other Ships we Fly:

Tri-Motored Ford, Bellanca, Waco, Stinson, Fledgling, *Five Fleets* and another Stearman.

GREETINGS

From down South in the land of plenty, where the summer spends the winter and commercial aviation is at its best.

We invite correspondence with all those who contemplate a career in aviation. Our new 1936 catalog and price list is now available. Eleven good super-courses on the ground and in the air. Our aircraft are unequalled anywhere. A complete school in all respects—over nine years of successful operation—1000 graduates. *Come to Dallas and be months and money ahead.*

Dallas Aviation School
And Air College

Love Field **Dallas, Texas.**

USE THIS COUPON

Dallas Aviation School and Air College, Love Field, Dallas, Texas.
Gentlemen: Send the new 1935-36 Catalog and information on the course checked.

- ☐ Amateur Pilots Course
- ☐ Advanced Aviation and Mechanics Course
- ☐ Master Airman and Transport Pilots Course
- ☐ Transport Pilots Course
- ☐ Limited Commercial Pilots Course
- ☐ Private Pilots Course
- ☐ Master Mechanics Course
- ☐ Aircraft Instruments and Radio
- ☐ Combined Limited Commercial and Advanced Aviation and Mechanics
- ☐ Combined Limited Commercial and Master Mechanics
- ☐ Combined Private Pilots and Advanced Aviation and Mechanics
- ☐ Combined Private Pilots and Master Mechanics
- ☐ Combined Amateur Pilot and Advanced Aviation and Mechanics
- ☐ Combined Amateur Pilot and Master Mechanics

Name ________________ Address ________________

CESSNA C34

Certified Performance

DETROIT NEWS PERFORMANCE CONTEST NATIONAL AIR RACES CLEVELAND 1935 CIRCUIT RACE
DETROIT NEWS PERFORMANCE CONTEST NATIONAL AIR RACES CLEVELAND 1935 SPEED
DETROIT NEWS PERFORMANCE CONTEST NATIONAL AIR RACES CLEVELAND 1935 COMFORT
DETROIT NEWS PERFORMANCE CONTEST NATIONAL AIR RACES CLEVELAND 1935 CIRCUIT RACE
NC

We are, quite naturally, proud of these trophies won at the 1935 National Air Races; and we are proud to have Cessna officially designated the World's Most Efficient Airplane—but actual day-in, day-out performance of the C34 is more important than trophies and titles to the private owner. That is the reason people are buying Cessnas as fast as we can build them.

Cessna C34, a four place cabin land monoplane, is powered with a Warner Super Scarab 145 h.p. engine. It has a cruising radius of over 500 miles, and flys 16 miles per gallon of fuel.

GUARANTEED PERFORMANCE—*with wood prop*:

High speed, fully loaded, sea level	162 m.p.h.
Cruising speed, fully loaded, sea level	143 m.p.h.
Landing speed, with wing flaps down	47 m.p.h.
Climb first minute	1,000 ft.
Service Ceiling	18,900 ft.

PRICE $4,985, f.a.f.

CESSNA AIRCRAFT CO.
Wichita, Kansas

GENERAL Headquarters—for Aviation—is found at San Diego. Ryan School of Aeronautics is located at the scene of the most intensive and widest variety of aeronautical activity to be found anywhere in America. Students are in close contact with these important activities:

1. The U.S. Navy's largest flying base, North Island, directly across San Diego Bay, operates continually over 400 planes of every variety.

2. Government aircraft and engine repair shops—largest and finest in existence.

3. The most active aircraft manufacturing area in the world. The factory of the Ryan Aeronautical Company, with which the Ryan School is affiliated, is directly adjacent; and only 100 feet north of the school on Lindbergh Field is the huge new factory of the Consolidated Aircraft Corporation, with over 240,000 feet of floor space; while within a 100-mile radius are located the factories of Douglas, Lockheed, Northrop, Vultee, North American Aviation, Kinner, Solar, Security, and Menasco. A demand by these and other concerns for Ryan graduates greatly exceeds the supply. Why? Because Ryan trained men have proven they are qualified to "fill the bill."

4. Year 'round flying weather. No one appreciates so well as the experienced pilot the advantages to the flight student of maintaining an uninterrupted training schedule. The government flying base was originally established in San Diego on account of its ideal conditions for aviation. This also accounts for Southern California's predominance in aircraft manufacturing activity. Its delightful, semi-tropical weather has brought international acclaim.

A SINCERE COMPLIMENT

The placement department of Ryan has a long list of requests from aeronautical concerns for recommended graduates, which is continually exceeding the number it is able to supply. Ryan training will prepare YOU for one of the many opportunities open for you in aviation!

Right now is the ideal time to start!

---

5. The Most Important Reason—the superiority of Ryan training. The Ryan School is the oldest aeronautical school under original management; fourteen years of training men for this industry—there is a reason for this record of consistent success. An impelling spirit of progress is the permeating spirit of the Ryan School. Ryan training above all else is sound, thorough, and modern. To make this possible, Ryan has a staff of instructors, every one of whom is outstandingly well qualified in experience and ability. Buildings, classrooms, shops, equipment, and facilities of all kinds are of the finest and meet the needs of modern training for this industry.

Ryan School is known as "America's Most Modern School of Aviation" and Ryan sees to it that this lead is maintained. Still more new buildings, new equipment and facilities have just been added.

Ryan IS the G. H. Q. You will choose most wisely if you select the school that will give you the best training, the most complete foundation and whose graduates have the greatest opportunity of realizing their full ambition in aviation.

Get the complete story on Ryan today. Check the course you are most interested in and full information will come to you immediately.

RYAN SCHOOL OF AERONAUTICS, Dept. AD 1
Lindbergh Field, San Diego, California

I am interested in courses checked: Please send additional information.

☐ Transport . . $1975
☐ Limited Commercial . . . 585
☐ Private . . . 585
☐ Amateur . . 295
☐ Master Mechanics $550
☐ Weems Navigation 150
☐ Aircraft Welding . 100
☐ Aircraft Radio . . 35

Ryan deluxe Combination Course Transport training plus new Ryan S-T high performance plane 4642

Name____________________ Age_____
Address____________________________

RYAN SCHOOL OF AERONAUTICS

Sikorsky

Over Land—Over Water

The recent cross-country flight to San Francisco of the first Hornet powered S-43 prior to its shipment to Inter-Island Airways of Hawaii, demonstrated that the S-43 will adequately meet flying conditions anywhere in the world. 𝕮 Others now under construction at the Sikorsky plant will see service in Europe, the far East, and South America. 𝕮 Where transport conditions require fast take-off, high cruising speed, minimum landing speed, and short turning radius, the S-43 will meet the most exacting requirements. 𝕮 The S-43 on land or water is worthy of the name — *Sikorsky*

S43

SIKORSKY AIRCRAFT, BRIDGEPORT, CONNECTICUT
DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

Taxiing ashore after a water landing

SHOULD AULD ACQUAINTANCE BE FORGOT
BETTER BUSINESS
1930

SUNCOOK MILLS

MAKERS OF

FLIGHTEX FABRIC

WISH

A HAPPY AND PROSPEROUS NEW YEAR

TO THE AERONAUTICAL TRADE

FLIGHTEX FABRIC

AERO DIGEST

Including
AVIATION ENGINEERING
VOLUME TWENTY-EIGHT NUMBER ONE
MEMBER AUDIT BUREAU OF CIRCULATIONS

COVER DESIGN

Wright-powered Douglas Sleeper Plane for American Airlines and the Lambert-powered Aeronca Low-Wing Cabin.

●

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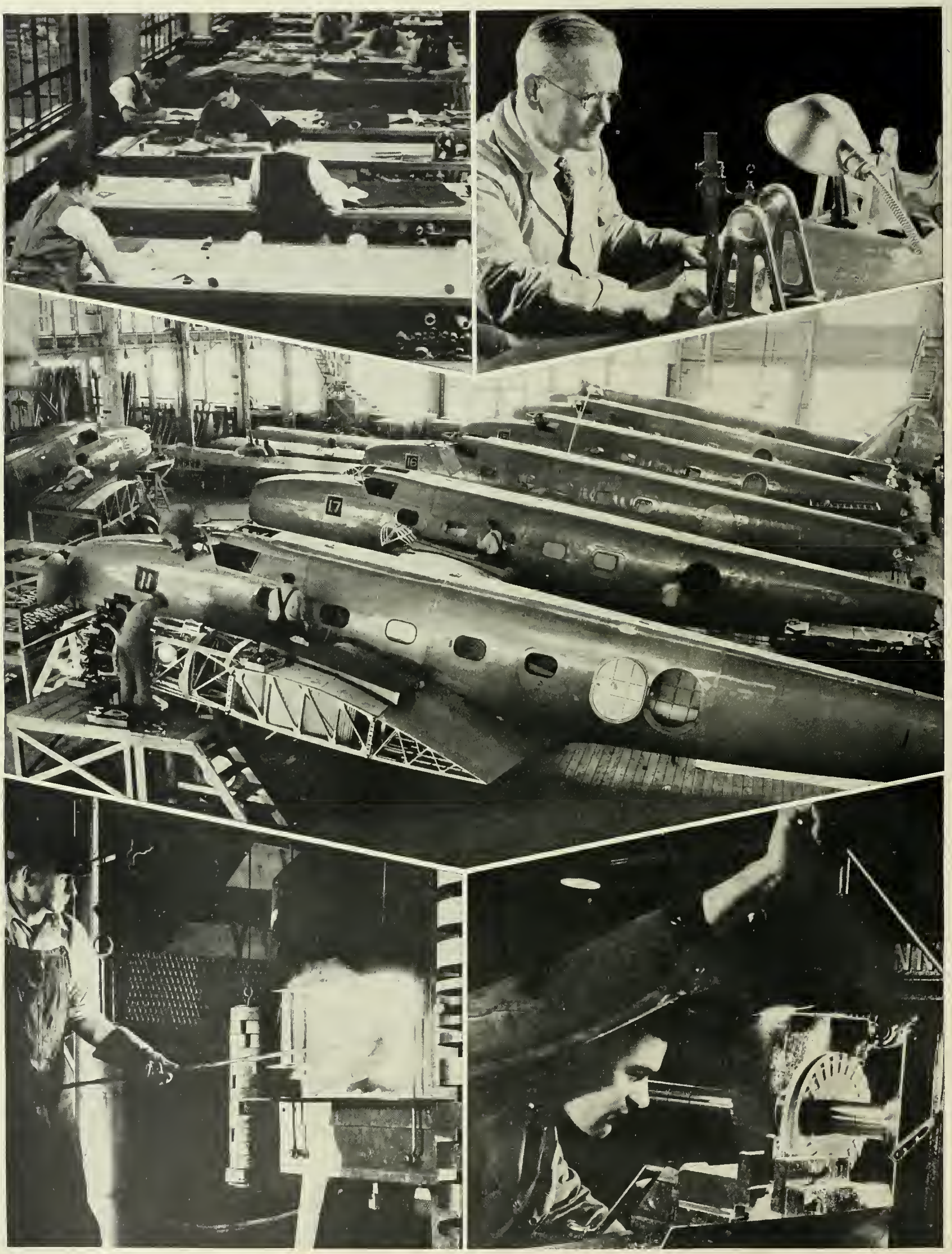


Group of Boeing transports progressing in production from design to final assembly

Major General Difficulties

●

CY CALDWELL

● Major General Benjamin D. Foulois, Chief of the Air Corps, completes four years as Chief on Dec. 22, and retires from the service Dec. 31, 1935, after 37 years in the Army and after 27 years' experience in Army aviation. Everyone is sorry to see him retire, except possibly the few Air Corps officers who are eligible for the coveted position of Chief of the Air Corps.

As this is written, it is now only a few days to Christmas, and I am reliably informed that several strong men of the rank of Colonel are hopefully writing wistful notes to Santa Claus, imploring him to put the job in their Christmas sox. Each night before retiring, it is rumored, they pray, "God bless papa and mama and Secretary of War Dern. And please, God, can you do anything about making me a Major General?"

Until this momentous question of who is to be the next Chief of the Air Corps is decided, all work in the Corps has dropped into second place in the minds of thoughtful officers. The work, after all, usually is pretty much routine, and what is going on now is going on the impetus given the Air Corps by Major General Foulois—when he was given time off by the various investigating committees to attend to his job of running the Air Corps. Incidentally, in the brief intervals afforded him while one committee was packing up to move out, and the next committee was packing up and hiring dress suits to move in, to investigate the Air Corps and Washington night life, Major General Foulois got in a few good licks of work. If he had been given more money and less interference we might even have had an Air Corps by now, with a few modern airplanes scattered here and there to break the monotony.

Whoever gets the job of Chief of the Air Corps is assured of my deepest sympathy, right from the start. If the Democrats remain in power for the poor fellow's term of office, he will probably face three investigations, two out-and-out condemnations without legal trial, and possibly a firing squad. Baiting the Chief of the Air Corps has become one of the minor diversions of Washington political life, and calling him a liar is practically anybody's privilege—so long as they vote the straight Democratic ticket and call Farley by his first name.

Let's see just what this unfortunate officer faces. In its report on the nation's air defense, published July 22, 1934, the War Department Special Committee on Army Air Corps recommended an increase in strength to 2,320 planes and a corresponding increase in the flying personnel. If that recommendation is accepted by Congress, if the necessary legislation is passed and the required funds are voted, the War Department plans to increase the G.H.Q. Air Force to 980 planes and at least 1,700 officers. The present strength of the Air Force is 360 airplanes (of which only 165 are modern fighting planes) and 635 pilots of all ranks.

The Air Force plan calls for 5 Bombardment Groups — 215 planes and 645 officers; 4 Pursuit Groups — 356 planes and 356 officers; 2 Long Range Observation Groups—88 planes and 352 officers; and Miscellaneous Cargo, Transport and Headquarters planes numbering 54, with 108 officers. That is a total of 980 planes and 1,728 officers.

This plan which provides for 980 planes for the Air Force provides for 2,320 planes for the whole Air Corps, including the Air Force, the Foreign Departments, the Training Center Schools, the National Guard, and the Corps Area Detachments.

The objective of the Chief of the Air Corps, then, is to meet that program. How is he going to do it under the present system of procurement?

The Chief of Staff and the Secretary of War have recommended buying 800 planes a year until this program is completed. But the only legal way of getting them, assuming that adequate annual appropriations are forthcoming, is by the system of competitive bidding initiated in December, 1933. This system has been so successful that in the sixteen months preceding November, 1935, the Army Air Corps, by herculean efforts, had succeeded in obtaining not one single combat plane. After two years of trial of the competitive bidding system, a few are just beginning to be delivered.

During the last two years insufficient planes of any type have been delivered even to take care of normal losses, to say nothing of any additional planes even to meet the requirements of the 1,800 planes authorized by the Act of July 2, 1926, commonly known as the Air Corps Act. That was the famous Five-year Plan, which was to have given us 1,800 *serviceable* planes in five years, or by 1931. It is now nine years since that Act was passed, and we have approximately 1,500 planes of all sorts and sizes and degrees of servitude, and even senility. Most of them are from four to eight years old, and are of no use for anything but training.

The reason for that breakdown in procurement in the past was the failure of Congress to appropriate funds. The reason for the breakdown in procurement during the past two years was not the lack of funds but the system of procurement, which has been made so long drawn out and complicated and bound up with legal difficulties that it is proving almost impossible to buy planes at all.

Here is a sample, under the present system, of how the Air Corps attempts to procure airplanes. Let us suppose that it wants, for example, the latest and fastest and most furious type of single-seater pursuit plane. It decides that it wishes to equip the Air Force with a couple of hundred of those ships. It sends out circular proposals for a design competition for that type of plane. Then it sits back and waits. It waits from six to twelve months before it is time to open the bids and learn what sort of ship the manufacturers have designed—they haven't built it, you understand, they've just drawn pictures of it and got it all figured out, including costs. What the Chief has now on his desk is a flock of papers numerous enough to paper all of the rooms in the Clark Hotel in Los Angeles.

For some three or four months the great engineering minds of the Materiel Division are seething over these plans, slide rules are slipping back and forth until they smoke, lengthy conferences are being held, the merits and demerits of the various designs are being discussed, and finally—oh, happy day!—an award is made to the lucky manufacturer, to the successful designer—for one airplane.

In a year the manufacturer, starting from scratch, manages to build that airplane. With pride and hope bubbling in his heart, he takes his precious product to Wright Field for tests. He must be patient, for it may take several months to test it. We'll suppose it gets through, and that everyone has breathed a great big sigh of relief.

The Air Corps, notified of this cause for rejoicing, now is permitted by law to place an experimental order for perhaps a dozen of the things, and when word of that is bruited abroad among the proletariat of the Air Corps, who meanwhile have been jogging about in PW 8's, there is much talk of the progress that we are making, and nobody would be the least bit surprised if this particular single-seater turned out to be the fastest in the world, or at least the fastest looking, which is just about the same thing, so far as you can see.

Having built one specimen, the manufacturer is a bit of an old expert by this time, so he girds up his loins and bats off those dozen planes of the experimental order in no time at all. Well, in from eight months to a year, which is practically instantaneous. If the Air Corps wants any more of them, he can now turn them out like sausages, for he is all tooled up for production, his men are proficient in their work and the whole factory can grind out single-seaters subconsciously. In fact, toward the end of that experimental order three men were discovered building a fuselage, all of them fast asleep,—and that was the best looking fuselage of the lot, at that.

The Chief of the Air Corps is about to give an order for 200 single-seaters, for the Air Force has just wrecked its last pursuit ship in Florida, or on the way to Florida, or coming back from the Air Races, or perhaps it was at Selfridge, on top of a freight train. No matter, we're out of ships, so he'll just order 200 of this fine new type from this fellow here, who knows all about building them. The Chief is about to say, "Here you are, my fine lad, here is a contract," when lo and behold! up rushes a myrmidon of the legal department, who shrieks, "Wait! Stop! Desist!" Naturally the Chief pauses and says, "What is it, Myrmidon?" and Myrmidon replies, reproachfully, "What, General! Is it possible you don't know that you must now hold *another* competition to see who is going to build these 200?" The Chief of the Air Corps pauses, aghast. He had forgotten it!

Well, all the engineering boys with pens and paper gather around him, and they heave and pant and send out a lot more proposals. "Who wants to build this nice ship that somebody else designed?" They all want to build it, naturally, every one of the manufacturers who aren't working, including six who haven't even got a factory, but only a grudge against those who have.

Finally, after six to eight months, bids are again opened and one of the manufacturers learns to his delight that he is the lucky bidder. He has taken the contract at a price at which he cannot possibly make money, because if he didn't get *some* sort of contract, the bank would take him over anyhow; and *with* a contract, even one that he was bound to lose on, he could pretend that he was still in business, and at least fool the bank until the last rivet was squeezed. Then the bank could squeeze *him*, and much good it would do them.

Now the manufacturer gets to work, ordering his material, and organizing the new help he has taken on. That takes a few months, before everything is coming in to work with, and everything is running smoothly. However, in from eight to twelve months he manages to deliver the *first* airplane of that 200-plane contract to the test board at Wright Field. Then he sits down on the field and chews a bit of grass, or goes off somewhere and gets drunk, all alone, to drown his apprehensions. For that airplane may run through the tests in a month, and then again it may not; as the thing has to meet every specification. And it just happens, naturally and inevitably, the same as it is natural and inevitable that there should be ice in the Polar regions, that no group of engineers and workers ever can build an airplane that meets every specification so exactly that a government legal officer could not pick a flaw in the fulfilling of that contract. So the manufacturer sits there, quietly going nuts, while he learns what he did do that he shouldn't have done, and what he didn't do that he should have done.

The manufacturer's contract called for 10 or 12 planes a month, we'll say. Suppose he got his contract on July 1, 1935, and it calls for the first one in, say, 10 months. That brings the date along to May 1, 1936, for delivery of the *first* plane. Then a month for testing it brings the date to June 1. He now finds that the plane is accepted, so he starts delivering the other 199 planes July 1, 1936. At 10 planes a month, he has 20 months in which to fulfill his contract; and he gives a shriek of delight, and delivers the last plane on March 1, 1938, having required nearly three years to complete his contract.

However, God be praised! there we are at last. The Air Force has all of its 200 single-seaters, brand new and shining—and only four years old from the standpoint of design! It's a masterpiece!—or rather, it was four years ago, when the Chief of the Air Corps first decided that he wanted it. Now, unfortunately, he doesn't quite know what to do with it; for it seems that nobody wants a single-seater any more. What they all want *now* is a multi-engine, multi-seat fighter, that they can really shoot down a bomber with, in case they want to. By this time the poor Chief is nearly frantic. "Aw, you don't really want to shoot down a bomber, do you?" he pleads. But the proletariat all say yes, they want to shoot down a bomber, and how are they ever going to do it in this thing, without getting shot down themselves, first? Then they all go out and stand around, just looking disconsolately at their obsolete planes—and they were only delivered recently, mind you!—and somebody, more heart-broken than the rest, says, "Well, thank God we gotta Navy!"

At that insult, the Chief of the Army Air Corps runs him through with a fountain pen and kills him, which doesn't really matter as he hadn't been enjoying himself in the Air Corps, anyhow. However, everybody looks harshly at the Chief of the Air Corps and shouts, "Murderer! Liar!" But of course that doesn't bother the Chief a bit, for Congressmen and other forms of low animal life have been calling him names like that at every investigation, so he's used to it. Besides, he's been Chief of the Air Corps four years, anyhow, and is fed up, so he'll retire with the rank of Major General,—and be damned to the lot of them!

And so it goes, my six readers, in the dear old Army Air Corps; and so it will go, unless something rational is done to obtain a fair and progressive procurement system.

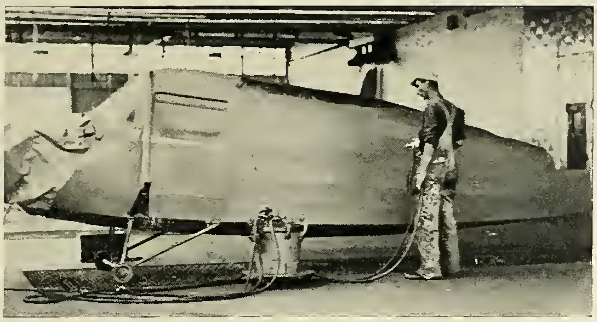
If negotiated contracts are illegal, they'd better take steps to do something about the whole thing or do without airplanes as we're doing right now. Our country must be protected by an adequate Air Force, and whatever arguments may be put up as to what *is* adequate, I don't think that anyone will deny that the present force of 165 airplanes is not adequate. These 165 are the modern combat planes—all the others are obsolete for combat.

The two most vitally important factors for the building up of the Air Corps are the following: (1). Adequate annual appropriations, every year, to procure not less than 800 airplanes per year until the 2,320 program approved by the War Department is completed. (2). A procurement system which will allow the Air Corps to procure aircraft ***promptly*** and *efficiently*, in order that annual losses of aircraft may be promptly replaced, and new aircraft provided of the most modern and up-to-date types. In other words, apparently we must return to the negotiated contract system.

There is a ray of hope. Let us start the New Year blinking at it, hopefully. There are, they tell me, some 490 planes on order, though most of them are held up, subject to Army test pilots' approval of the first of the series at Dayton. But they'll be coming along, I suppose, sooner or later, for a lot of money has been appropriated for them and for still more to follow. Congress has been good to us, giving us money for aircraft; the only thing it has to do now is to pass a law permitting the Chief of the Air Corps to spend it, without being charged with every crime in the calendar—which he undoubtedly will be if he doesn't watch out.

On thinking it all over, I believe that those Colonels who have been asking Santa Claus to put the job of Chief of the Air Corps in their Christmas stockings, would be well advised to write him another letter saying, "Don't pay any attention to my first letter, Santa Claus, I've decided I don't want the job. I was only joking. Give it back to General Foulois. Yours, with love, Danny and Conger and Oscar."

P.S. As we go to press we learn that Brigadier General Oscar Westover has been elevated to the position of Chief of the Air Corps with the rank of Major General. Evidently Oscar's second letter never reached Saint Nick.



Sandblast room showing fuselage being blasted

Steps in the Production of Aircraft for the Private Flier

●

J. HENRY REISNER

In Charge, Commercial Manufacturing
Fairchild Aircraft Corporation

● The past few years have brought a better understanding of manufacturing problems in the engineering departments and it is essential that production procedure be developed along with the design of the airplane to be produced. Costly errors in design, tools and time can be avoided if proper consideration is given to how the part or assembly is to be made before release for production. This procedure results in a better general scheme of manufacturing and quite often a larger number of interchangeable parts can be made from the same basic material, tools and equipment as explained elsewhere in this article.

After release of engineering information to the Production Dept. an estimate is made of all tools, jigs, fixtures, machinery and equipment required to produce the airplane economically in the quantities set-up by the Sales Dept. for delivery in a specified time.

Production Set-up

Lists and shop orders covering the material requisitions and routing of all parts are made up prior to starting actual production of parts. An experimental airplane is then built using the shop orders and material lists, tools, jigs and procedure as set-up. In this way any error in the set-up production scheme is discovered and corrected before the production run is started.

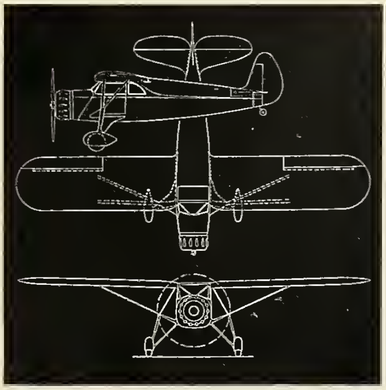
Accuracy, careful and thorough inspection of raw materials, as well as parts and assemblies in process, are essential to insure proper and satisfactory fitting of parts on the assembly line, and it has been proven that money expended to make detail parts accurately is paid back many times in savings effected in the assembly departments.

Production set-up necessitates having the right materials and processed parts at the right place at the scheduled time.

While production of wood wings is not new, several points between design and manufacturing of these parts in the Fairchild "24" are worthy of comment.

Spars are of solid spruce routed by forms on shapers to I section. Plywood reinforcements at all important fitting joints are then nailed and glued in place and final contours are cut to size. They are then jig-drilled for all bolt holes and dural bushings pressed into the drilled holes. These bushings increase bearing area in the wood and the plywood reinforcements further strengthen all joints against splitting of the wood, which would otherwise occur, due to minor accidents or abnormal deflection of the wing in violent maneuvers. Since welded steel tube compression members are used, a metal-to-metal contact between the compression member, lift strut fitting, drag wire lugs, and spar plates is obtained. This results in a rigid joint not liable to loosen due to varying changes in the wood, or change of moisture content which has been a serious fault in past wood wing structures.

The bolts through the rear spar also tie the aileron hinge to the compression member through dural bushings in the spar, again giving a metal-to-metal contact and insuring a rigid joint.



Outlines of Warner-powered "24"

Varnish is applied in spar holes before pressing the bushings into place, under all fittings and inside of the nose section before the plywood nose skin is applied to the wing.

The fuselage is of conventional welded steel tube construction but differs from current practice in the use of square-section tubing for longeron and vertical members, and round-section tubing for diagonals. This saves time in fitting of joints, allows all members perfect alignment, which in turn, produce a stronger joint and less welding.

Stampings and Dies

Fittings are welded direct to the fuselage structure for installation and attachment of all controls, seats, fairing, windshield, floorboards, etc. Since such parts are made in jigs, accuracy in alignment in the Assembly Dept. can only be had if locations for these parts are accurately established on the fuselage structure.

Landing gear and tail-wheel hinge attachment points are fitted with bronze bushings pressed into place after welding and sandblasting.

Sheet steel stampings are made in punches and dies. Smaller quantities of stampings are made with punches and dies of 4130 sheet steel, heat treated after shaping.

Two general types of blanking and piercing dies are shown in the accompanying illustration. The dies at the left of the progressive, blank and pierce in two operations, due to the parts design and gauge of the sheet. Those at the right, however, for a part of lighter gauge and smaller shear length, blank and pierce in one operation. In the latter case pressure on the blank is held by rubber inserts in the punch and die faces, which also push the part out of the die.

Spinning form showing cowl with spun nose after "hats" are pressed

A study is made of all stampings, involving quantities per ship, to determine the most economical way to produce the parts and with present-day volume of production it is considered reasonable to say that quantities of more than 100 pieces justify the cost of blanking dies of the type outlined.

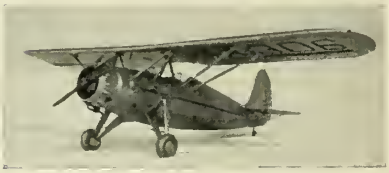
Forging Dies and Welding

The use of ball-bearings in all control surface hinges and control operating mechanisms has ended the need of continual attention on the part of the owner to avoid undue wear and sloppy controls in this part of the airplane. Since push and pull tube controls are desired for maximum reliability, any wear in control joints is immediately evident, which is not the case with cable controls due to the tension in the cable hook-up. The adjustable screw type and the terminal welded into the tube are made from the single forging immediately above the parts. Standardization of various sizes of bearings have made it possible to justify the expenditure for forging dies. As a result, the design of the forging was so developed to permit machining of the bearing fit prior to welding into the tube. The tail surface hinge is made of 2 pieces —a bushing machined in the turret lathe and a sheared and punch press formed strap. The bushing is reamed to size during machining and the strap is welded around the bushing's lip edge. The design of the part again permits machining the part to size before welding, and alleviates reaming or machining after assembly. The design of some of the forgings was developed to permit its use in many places by machining the faces to various dimensions and drilling various hole sizes. Only one set of tools has been needed in more than a dozen applications of the basic forging.

Welding technique should be developed to avoid any strain in the part or assembly due to welding. Welding straight across the grain of metal is a dangerous procedure and is but one of the many practices to be avoided. The alignment of welded structures is dependent on the proper progressive welding of the joints and close adherence to the adopted procedure when once established. Careful design to avoid the necessity of welded clusters in the middle portions of assemblies and welds in the middle of long unsupported columns results in safer and better welded parts.

Landing Gear Design

Attention to landing gear design to effect "foolproof" ground handling for the amateur pilot has been a paramount aim in the "24" and the development has resulted in a simple and strong structure. The welded steel tube frame to which the wheel spindle is attached is heat treated as a unit. The oleo strut is a result of extensive tests in a specially-built test machine to develop the best oleo strut for the particular conditions which it would be required to meet.



Warner-powered Fairchild "22"

The increasing quantity of cowling, filletings and fairing has brought forth many new methods and processes for their fabrication.

Fuel Tanks, Cowling and Fairings

The "24" fuel tanks are built up from a pressed body sheet of aluminum, 2 pressed baffles and a flat cover sheet. All beading, the sump and end radius, are pressed in one operation with hardwood dies in the hydraulic press illustrated. Baffles also are pressed between hardwood dies and are riveted into the tank body. The top cover plate, however, is welded only around the edges and is attached to the baffle with screws which thread into stop nuts attached to the upper baffle flange. Since there is minimum distortion due to welding, a smooth top surface, which is exposed to the slipstream, is obtained. Damaged tanks can easily be repaired by filing loose the welded edges and removing the screws in the top plate, giving access to the interior.

Wheel pants are pressed in two halves, right and left being made from the same pressing. A hardwood punch is used to draw the metal through the pressure plates on which pressure is built up by springs as the stroke of the press moves up. The two halves are riveted together to make disassembly easy.

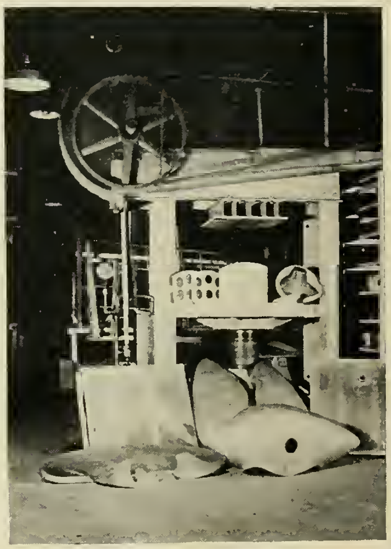
The "hat" type NACA cowl used on the "24", is pressed and spun from a single sheet and has no joints. As the sheet is passed through the die the hats are formed progressively around the sheet. The two ends are then joined together and placed on the spinning form. The rear edge is spun down first and clamped. The nose is then spun over and the recess for the nose reinforcement ring is formed with a spinning tool. The cowl is then removed from the spinning form and mounting. Brackets and hinges are then installed.

The development of spinning technique is a matter of practice and study of the part to be spun. As a result even sheet thickness is held in the parts.

Punch Press Operations

Strut fillets and other odd shapes are pressed in cast lead, or babbit dies made from a plaster paris pattern, which in turn is made from a sample part (handmade) to fit the job. The sheet metal blank is laid in the die and a rubber block is put on top of the sheet against the punch press ram. The rubber is restrained from flowing out of the die, and as a result the sheet metal blank is squeezed into the shape of the die.

The aileron nose and tail ribs are blanked and formed on the punch press. The nose skin, beam and trailing edge



Hydraulic press showing few of parts formed with hardwood tools are formed to size and shape on a universal bending brake. All parts are drilled prior to assembly in the jig and due to the care in layout and design of the aileron, 90% of the riveting is done with a pneumatic squeeze gun.

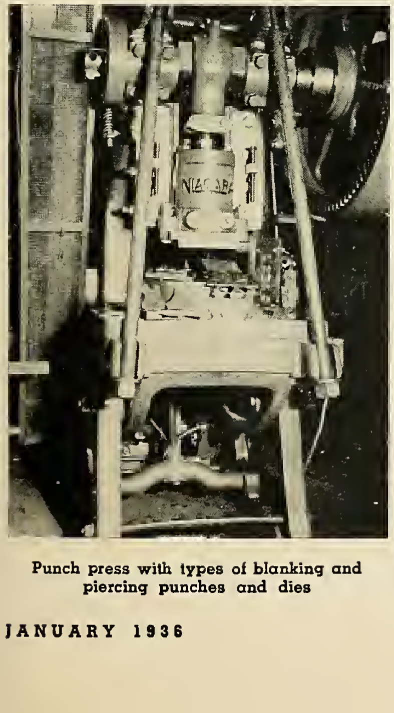
The Fairchild flap is made of a continuous sheet of aluminum alloy formed to shape on the universal bending brake. Nose and tail ribs are made of spruce and the parts are assembled in the assembly jig. Drill plates are a part of the jig and the skin and ribs are drilled and riveted through in the jig. This type of structure is particularly adapted to thin surfaces and is strong and light.

Selecting Materials

The selection of materials and the specification covering the protective finish to be used to maintain the design calculated strength of the parts over the entire life of the airplane is again a function of engineering in close co-operation with production methods.

Specification of aluminum alloys, steel, glue, dopes, lacquers and all materials must be considered and weighed against one another to guarantee selection of the material best suited to the job. In selecting the particular aluminum alloy sheet for NACA cowls eleven alloys were tested and checked to determine which material was most satisfactory to fabricate and stand up under service tests on the airplane.

Cheap dopes, lacquers and paints do not mean lower cost for the painted and finished job. Quite often cheap prices per gallon mean that more gallons of material are required to produce the degree of protection and finish desired.



Punch press with types of blanking and piercing punches and dies

Thoroughness in processing and finishing is one of the more costly items in manufacturing aircraft at present, and its importance is readily understood when it is pointed out that aircraft structures of light weight employ only enough structural material to carry designed loads with margins of safety as required by regulations. Maintenance of these margins by proper protection against corrosion, rust, etc., are, therefore, highly essential and the materials which are used for aircraft construction unfortunately are not always of a type which inherently are capable of withstanding severe conditions in operations.

Steel parts and welded steel structures in the "24" including the fuselage are sand-blasted after welding and handling. This process removes scale from welds and tubing, and exposes any cracks in the welds or tubing, which otherwise cannot be seen. Secondly, it provides the finest surface known for application of protective finish.

After sand-blasting and inspection, small steel parts and completely welded steel parts without laps or pockets, where liquids in the plating bath can accumulate, are cadmium plated. Welded structures, which are not practical to plate are coated with oil base enamel if inside the covering, or primed and lacquered if exposed.

Warner-powered Fairchild "24"

Wood parts and structures are coated with varnish of the synthetic resin type, care being taken to seal the edges of the plywood panels.

The spray exhaust system and conveyor system used in the dope room of the Fairchild plant is illustrated. Spray dust and fumes are drawn into tapered pits under the floor covered with grille plates. A sprayed stream of water runs in the pit, and carries the dust and dirt outside the room into a sludge pit. As a result the dope room is kept clean and the exhaust fans and stocks remain cleaner because dust and dirt are not carried through them. Close control over temperature and humidity is maintained by automatic blowers and air intake shutters.

Processing is concentrated in one department, containing equipment for cadmium plating, heat-treating steel and aluminum alloys, anodizing, polishing, and cleaning metals.

Fairchild "24" wing at strut attachment

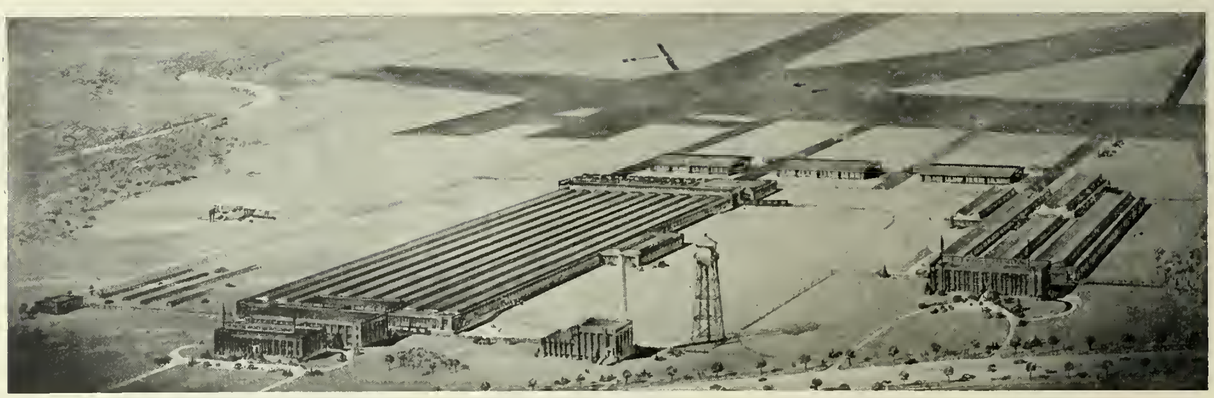
Heat treating furnaces for steel work and salt tanks for heat treatment of aluminum alloys are of the gas fired type with automatic controls and temperature recording instruments.

The assembly department is divided into groups starting from the place where the fuselage skeleton reaches the assembly line. These groups are called assembly positions and a definite group of parts and minor assemblies are installed in each position. Manufactured parts, purchased parts and materials are forwarded from the stock room or manufacturing departments direct to storage racks and bins at each assembly position. This makes it possible to maintain an accurate control of parts production and materials since the quantities at each position can be checked at all times and renewed.

Close relation between design and manufacturing are extremely important. Given a definite design which must have inherently useful values to the prospective owners, it is the joint responsibility of the design and manufacturing departments to present that useful value in a serviceable and reliable product.

This cannot be accomplished by a sacrifice of quality in manufacturing methods, or materials. If this product is to be useful and reliable in the hands of increasing numbers of amateur and sportsman fliers, as well as skilled pilots and operators, cheap materials and cheap methods cannot be used to beat down the present high costs. After all, manufacturing labor costs at present, represent about 10 percent of the selling price of most planes now on the market.

On the other hand, increased usefulness, easier and safer flying characteristics which can open up broader and larger markets to increase the volume produced, seems to be the straight-forward answer. That is a responsibility of design and manufacturing—and neither one can do it alone!



Architect's perspective drawing of Pratt & Whitney and Vought factories and Rentschler flying field

Aircraft and Engine Factory Layout

MORITZ KAHN

Vice-President, Albert Kahn, Inc.
Architects and Engineers

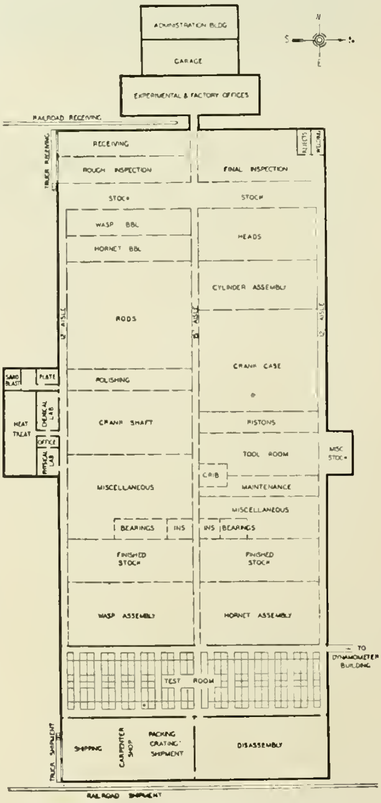
Manufacturers are accustomed to think that appearances are of little consequence in so prosaic a place as a factory. It is even taken for granted that ugliness in a factory building is inevitable. But there is really no necessity why factories should be ugly. Many of them—like the Pratt & Whitney Aircraft Co.—are quite imposing, and all might be at least presentable.

● When undertaking the construction of a new factory building it is necessary to recognize the fact that cost and speed of production, and quality of the product are materially affected by the general design and layout of the plant, and that many factors will determine the value of the service it will render.

Aside from the proper grouping of departments to simplify the process layout (a subject dealt with later) consideration must be given to the requirements which will arise as the business grows—in this way making certain that manufacturing will always be carried on with the utmost efficiency. A well-planned building, when originally designed, will be laid out so that expansions can be accommodated without disturbing the general scheme of operation.

Of importance only secondary to that of proper layout are the subjects of ventilation and lighting, both natural and artificial. Even the best of equipment, most suitably arranged, cannot be operated efficiently unless employees are provided with proper working conditions. This is all the more important because a capable designer will effect results of adequate natural ventilation and lighting throughout the entire plant at very little, if any, extra cost of construction by proper side-wall fenestration in the case of multi-story buildings, or with suitable roof contour in the case of single-story buildings.

Assuming the qualification of the manufacturer to prepare his own process layout, an architect specializing in the design of industrial buildings will be able to assist in obtaining a co-ordinated grouping of departments through logical and systematic arrangements. He will contribute to the problem an independent approach consolidating ideas derived from similar problems encountered during the course of his experience.



Pratt & Whitney production layout

There are a few general principles which apply to every type of manufacture. They are (1) materials in course of production should be transported the least distance with the least amount of handling; (2) departments for successive operations should be arranged for straight line production with the least crossing or retracing of the line; (3) the sizes of departments must be properly correlated to eliminate bottle necks and wasteful large areas; and (4) the various departments should be so laid out that they can be easily re-located or expanded as methods of manufacture change and as the industry grows.

Application of these general principles is exemplified in the plant constructed for Pratt & Whitney Aircraft Co., at East Hartford, Conn. In this plant, departments are arranged to assure continuous flow of materials and parts from the receiving department at one end, straight through to the dispatching department at the other end. There is neither crossing in the production line to cause congestion, nor retracing of the line to cause unnecessary cost.

When construction of this plant was originally contemplated, the first prepared layout involved the use of multi-story buildings, a type of structure which is advantageous for many methods of production, especially when gravity can be used in the handling of materials. The relative compactness of a multi-story building shortens the line of transportation and facilitates supervision. Study of the particular problem, however, finally resulted in the selection of the single-story type of building, especially because the trucking system is used to handle materials. The results attained in the completed structure have demonstrated the correctness of the layout eventually adopted. The plant is an outstanding example of the complete elimination of

A portion of the Pratt & Whitney assembly department

lost motion, and the general scheme of operation cannot be detrimentally affected by any future expansion. When preparing the general layout for the plant the architects had to co-ordinate its operations with those of the adjoining plant for the Chance Vought Corp., for which they also were architects. The juxtaposition of the two plants is shown in the accompanying plot plan.

The group of buildings of the Pratt & Whitney plant, occupying an area of 60 acres, comprise a two-story administration building having a floor area of 28,500 sq. ft., a personnel building, an engineering laboratory, 42,750 sq. ft. area, a main manufacturing building 1000 ft. long with a floor area of 400,000 sq. ft., a 1500 h.p. boiler house, and a garage.

Directly in back of the administration building and connected thereto by a bridge, is the engineering laboratory. Behind the latter is the main manufacturing unit. Notwithstanding the fact that all buildings embody most modern details of construction and the best quality of materials and workmanship, the construction cost proved moderate.

The main factory unit is a single-story monitor type of construction with column spacing of 40 ft. in one direction and 32 ft. in the other, and a clear story height of 14 ft. from the floor to the underside of the roof trusses. Ample natural lighting and ventilation result from the form or contour of the roof with its large expanse of monitor sash which can be opened by mechanical operators. These monitors face north and south,—conceded the best conditions for manufacturing purposes. As for natural lighting, there is clear daylight throughout the entire plant.

The line of flow of material and work centers in a 15 ft. trucking aisle which runs longitudinally through the center and entire length of the building, with a 12 ft. aisle at each side of the building paralleling the center aisle. Raw material is received at the west end and is transported through the departments of successive operations to the Dispatch Dept. at the east end of the plant. The work flows from the side or feeding aisles through the departments to the center main transportation aisle.

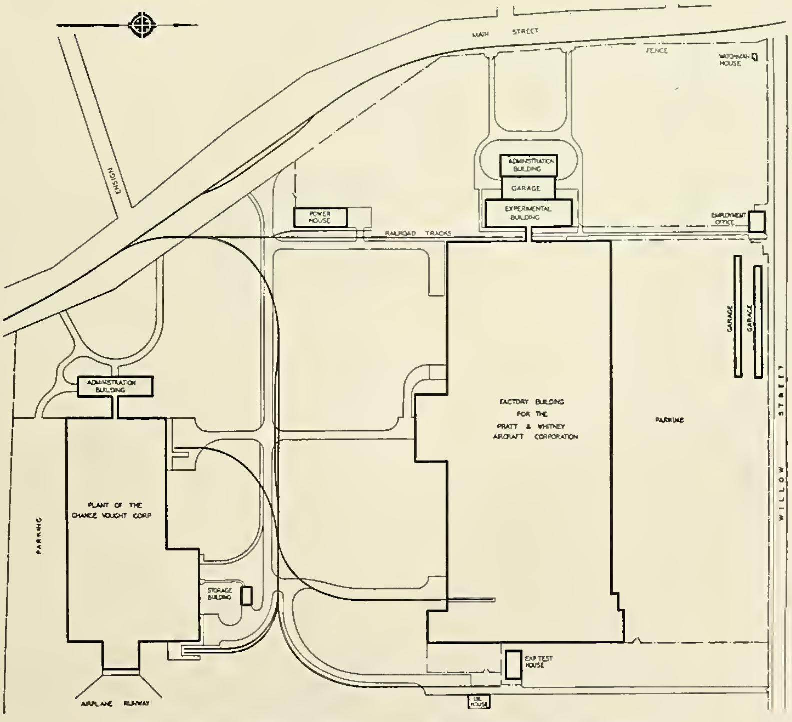
In general the materials used consist of aluminum parts and steel parts. The former are machined on the north side, the latter on the south side of the center aisle. This arrangement facilitates the piping of cutting compounds which are naturally different for aluminum and steel. It also facilitates handling and segregation of the turnings, borings and drillings.

The railway siding at the west end of the plant feeds the raw materials and purchased finished parts into the Receiving Dept.; the raw steel passing into this unit south of the center aisle, the aluminum parts north of this aisle. The materials are then inspected and passed through to the adjoining rough stores.

The Cylinder Barrel Dept. adjoins the Rough Stock Dept. south of the center aisle, while the former adjoins the latter on the north side of the center aisle—the rough stock being fed into both these departments through the feeding aisles. This stock, as it is subjected to the various machine operations, works towards the central transportation aisle along which it travels eastward to the Cylinder Assembly Dept. After the materials are assembled, the parts continue eastward along the center aisle to the Finished Stock Dept., to be used as necessary.

Likewise connecting rods, link rods, crankshafts, crankcases, pistons and miscellaneous parts are fed through their respective departments from the Rough Stock Dept., the material again being worked towards the center aisle in the machining operations, and being eventually transported through the center aisle to the Finished Stock Dept.

Polishing operations are performed in a separate department located approximately midway between the Rough Stock and Finished Stock departments. Parts which require polishing are fed into this department through the feed aisle as before, and the work again travels towards the center aisle through which it is transported to the Finished Stock Dept. An exhaust system installed in the Polishing Dept. removes dust from the atmosphere, and eliminates the possibility of any dust



Plot plan, Pratt & Whitney Aircraft Co. and Chance Vought Corp.

Tool and Maintenance Department, Pratt & Whitney Aircraft Co.

getting into the engines during assembly.

The Tool Dept., where jigs, fixtures and special equipment are made, together with the main crib where tools are stored, are combined with the Maintenance Dept. and are located near the center of the aluminum section of the building immediately west of the Finished Stock Dept. By placing these departments near the center of the plant, distances to and from the various process departments are shortened. Furthermore, the Tool Dept. thus located will always remain in the center of the plant when future expansion takes place either north or south of the main portion of the building already erected. While the master tool crib is in the center of the plant, sub-cribs are located in each department and are under the jurisdiction of the respective foremen. Tools are handed out to the workmen on the checking system.

Located centrally in the building on the steel side is the Metallurgical Dept., which consists of a heat-treating division and a chemical and physical laboratory. In view of the fact that the steel parts alone require heat treatment this department will always be centrally located when expansion takes place on south side of the building.

Finished stock is stored in the Finished Stock Dept. in the order in which it is to be used in the Assembly Dept. immediately adjoining. These departments are separated by open racks or shelves instead of the wire partitions used to separate the other departments. Partially finished stock is stored in tote pans placed on the shelves, whence they are passed to the sub-assembly benches located in the immediately adjoining assembly departments. A color scheme is used for the tote pans,—different colors indicating whether the material is to be used for Army or Navy orders. The various parts are assembled into sub-units on the sub-assembly benches as they continue their eastward journey through the plant. Relatively large spaces are provided around all sub-assembly benches so the men will have ample room. There are two parallel main tracks running north and south in the Assembly Dept. east of the sub-assembly tables. Assembly racks travel on these tracks, one for Wasp, the other for Hornet engines. Assembly starts at the south end of the department and works north to the central transportation aisle. Fully three-quarters of the floor space around the Stock Room is devoted to the assembling of engines, while the balance of the space is used for dis-assembling, inspection, and re-assembling after the first run-in of the assembled engines.

Various component assemblies are fitted and inspected at work benches in the aisle, and are then fed into the production line as the assembly racks pass along. Operations start on the rear section of the engine at the first assembly bench. The cored oil passages are sealed, oil pipes installed and studs for accessory mountings are turned in. Upon the completion of this operation the assembly rack is pushed along to the next assembly bench where the blower section, which is also the mounting section of the engine, is put together. The induction fan, its shaft and gear train, are mounted on this part. The blower is then bolted to the swivelled assembly rack through the mounting bosses as it would be in an actual plane, and the accessory section is then installed. Bushings for the accessory drive shafts are fitted and reamed, the drive-shafts and gears installed, the oil pump and magnetos mounted, and other accessories installed.

At the next bench the main crankcases are assembled, the rear half being bolted to the opposite side of the blower from the accessory section. After this is in place the crankshaft is inserted, the connecting rods fitted, and the crankshaft rear gear with the induction fan clutch added. Thereafter the front half of the main crankcase is bolted on, the oil-bearing bracket is secured, and the cam and cam gear drive with adjusting sleeves are slipped over the crankshaft. The nose section, which mounts the tappets and thrust bearing, is set over them and the ignition wire harness is attached. By the

(*Continued on page* 102)

General view of a portion of the Connecting Rod Department

AIR
HOT AND OTHERWISE

FRANK A. TICHENOR

● Above all the war whoops and rebel yells over the Air Commerce Director's insolent activities one note of agreement rings clear. Broadly speaking, both the industry and the Bureau are in accord in wanting to see private and miscellaneous flying greatly increased. The bitter disagreement arises only out of the question how this should be accomplished. The Director of Air Commerce would like to see it done in one fell swoop—by the Government, to the everlasting glory of Eugene Vidal. The industry, comprised as it is of business veterans who have battled and bled to win the ground they hold, knows that that method is just so much tommyrot. Sane men, they know there are no miracles in the business world, even with the Government waving a magic wand. They resent the Government's attitude, both because it is an insult to their own intelligence and ability and because it means Government meddling in the domain of private enterprise. Their whole experience has taught them that such meddling inevitably results in only one thing—bungling.

But when Mr. Vidal interprets this attitude on the part of the industry as meaning that aviation's business men do not want to see private flying grow, that they are simply acting like a pack of Peck's Bad Boys who don't know what's good for them, he is being too utterly childish to bother arguing with. The industry *does* want private flying to grow. It wants it far more than Mr. Vidal—and for a much more substantial reason. But it wants that growth to come about in a normal reasonable manner.

It is a mistake for the industry to assume, however, that "a normal reasonable manner" means letting events just take their own course. There is much the industry can do—much that it *must* do—to accelerate the development of this phase of aviation. Through the years, a great deal of debris has accumulated in the path leading toward that goal. Unless it is cleared away, the growth of private flying will be retarded many years.

* * *

It would be too much here to attempt to discuss all the various kinds of litter that stand in private flying's way—high maintenance and repair charges, excessive aircraft insurance rates, prohibitive life insurance premiums for pilots, hangar rentals, the absurd and ineffectual 50-hour license requirement and a host of others. It is enough to cite one example:—the terrific mark-up on aviation gasoline at most Middle Western and Eastern airports. By and large, this is the result of the same factors as the other and subject to the same cure.

None of these things are deliberate abuses. High gasoline prices and exhorbitant repair charges are not the depredations of a gang of plunderers masking under the name of fixed base operators. On the contrary, like Topsy, they "jest growed." They are weeds in the garden. They were permitted to grow to their present ugly size because nobody could identify them when they were first sprouting; nobody knew then whether they were fruit-bearing plants or poisonous.

During the depths of the depression, when customers were few and far between, it seemed the better part of wisdom for airports to squeeze every possible source of revenue to the last drop. In that method they thought they saw their only chance of survival. Customers, they reasoned, would be no more numerous or no fewer no matter what they did. They were selling to aviation's incurables, the pilots who loved flying with such passion that not even hell, high-water or the dungeons of depression could induce them to give it up. Why not, then, charge 28 cents a gallon for gasoline on which the oil company's posted retail price was 18 cents? There and there only in those dark days lay the hope of salvation.

But times are changing, and practices that meant salvation a few years ago mean suicide now. Money is a little freer, and many people who have been waiting only for the return of economic sunshine to take up flying are ready at last to climb into a cockpit. The recent tremendous and steady increase in student pilots is evidence enough on that score. But these people are different from those who kept on flying during the depression. They are not extremely wealthy. Neither are they incurable aviation addicts. They can easily be scared away. They *will* be scared away unless something is done to remove the stone walls against which they are now butting their heads.

* * *

This is not idle theory. It is fact. Check up for yourself at airports throughout the Middle West and East. Check the gasoline companies' posted retail prices; then check the prices for the same gas on the field. You will find shocking discrepancies. You will find, for instance, as one well-known pilot did who took the trouble to investigate, that at a certain airport in Missouri the price for 73-octane gas was 26 cents per gallon net while the posted retail price was 17.9 plus a refundable 2-cent tax . . . at a big airport in Indiana the price on the field was 28 cents net while the posted retail price was 16.4 cents, exclusive of a 4-cent refundable state tax . . . at airport after airport the mark-up was as great or greater —8 to 12 cents above the posted retail price. In other words, these places were taking a profit of from 12 to 16 cents.

* * *

We repeat—such prices may have been justifiable, even necessary, during the depths of the depression. Today they spell ruin. For it is nothing less than ruinous to try to win a race with a hundred-pound weight chained to your ankle. A few far-seeing men have already recognized this. Gasoline prices around Los Angeles, for instance, are 10 to 12½ cents per gallon lower than in the Middle West and East. And in East St. Louis, Oliver Parks and Major Wassall, of Steinberg Airport, have definitely committed themselves to a policy which is at once astute and magnanimous. It is best explained in Mr. Parks' own words:—

"We decided that we should do everything in our power to stimulate private and miscellaneous flying, and that one step in the right direction would be to establish more reasonable retail prices on aviation gasoline. As a result of this conference, we have both agreed that we will sell 73 octane aviation gasoline to all buyers at 21¢ a gallon; 80 octane aviation gasoline for 23¢ a gallon; 87 octane gasoline at 25¢ a gallon. These prices include all taxes. We believe with this policy we can set a good example to the other aviation operators who are really interested in improving their business by promoting private and miscellaneous flying."

It is this point of view which strikes the new note in aviation. Nobody in this business is going to prosper until airport and fixed base operators everywhere shed their depression practices and recognize the simple arithmetical fact that a one-dollar profit from each of five planes is more money in the coffer than a three-dollar profit from one plane.

Heat Treating and Anodic Oxidation Equipment

B. V. KORVIN-KROUKOVSKY,

Chief Engineer, Edo Aircraft Corporation

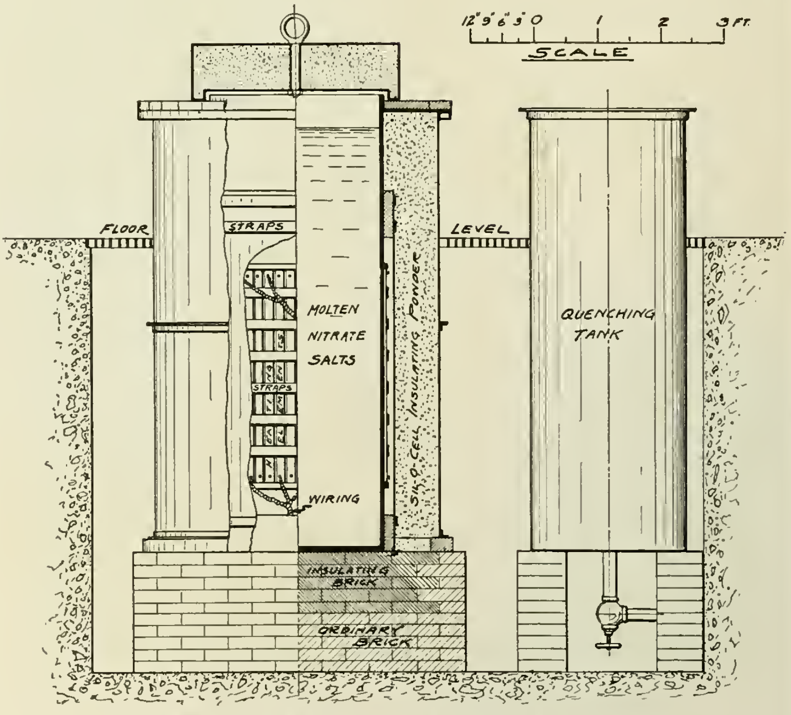
● The plant of the Edo Aircraft Corp. has been built specifically for the production of aluminum alloy seaplane floats and flying boat hulls, and two important processes of working the metal—namely heat treatment and anodic oxidation treatment received early attention. The heat treatment of duralumin is a simple process consisting of heating the part to 950° F. and quenching it in cold water. The subsequent aging takes place automatically at room temperature and requires no further attention. Yet the simplicity of the process calls for special consideration in the choice of equipment, for it is not customary to employ special men to do the heat treating. Everyone in the shop has to use the furnace freely as his work requires, which means that equipment must be readily accessible, foolproof and simple to operate.

In order to make the furnace readily accessible, it had to be placed in the middle of the shop, equally distant from the Detail Dept. on one side and the Assembly Dept. on the other. This location led to the choice of electricity for heating, as it provides safety from fire, is cleanest, and needs no stack. The high cost of electricity required, however, careful heat insulation for economy. Cost of electricity depends not only on what is actually consumed, but also on what may be used, i.e. the fixed charge based on maximum demand on which depend the sizes of transformers and wiring. For this reason the use of heavy current for rapid heating would be costly, and had to be avoided, both because of the maximum demand charge and the initial cost of equipment. These expenses were avoided by making a large salt bath, well insulated and kept at uniform heat treating temperature day and night by a Wilson-Maeulen controlling pyrometer.

Besides economy, this system is foolproof, since there is no time when the heat treating temperature is not correct. Reliability is further increased by the fact that the large bath containing 4500 lbs. of nitrate salts has sufficient heat capacity not to appreciably change temperature with any charge which is likely to be put into it.

The construction of the furnace is shown in the accompanying drawing. The salt pot is made of 5/8″ steel plates, with all seams welded both inside and outside. The pot rests on the foundation of insulating bricks. Strip heaters with high temperature sheath are clamped around the tank by eight steel straps. Straps are connected together by vertical strips of steel extending below the lowest strap, and resting on the foundation in order to prevent possible sliding down. Around the strip heaters and their wiring is wrapped a large sheet of wrought iron separated from the pot and heaters by a layer of circular insulating blocks placed above and below heaters. The sheet and blocks are held in place by steel straps. A jacket made in two halfs of 16 gauge steel with edges reinforced by angle iron is then placed around the entire assembly leaving a space about 10″ wide between the jacket and the pot. This space is then filled with insulating powder through the holes in the upper flange of the pot. Closing these holes with covers, and paving the flange with insulating bricks completes the erection. Heat treating engineers will undoubtedly criticize the presence of the flange mentioned above because it evidently permits heat leakage in an otherwise well-insulated furnace. This sacrifice was necessary, however, in order to thoroughly protect the insulating powder from the drippage of nitrate salts, which would quickly destroy its insulating value.

Careful arrangement of the electric heating elements is an important factor in the efficient operation of this furnace. Strip heaters are not usually recommended for high temperature work, but the chromalox strip heaters made by the Wiegand Co. were recommended for dark red heat, and were chosen because of their ease of installation. The estimate of heat transmission from the heaters through the wall of the tank to the salt showed that with salt at 950° F., the heaters must have a temperature of about 1250° F. It was not considered safe to subject the heaters to their rated load at this temperature and they were connected in series to work at approximately half of rated capacity. In this way 63 heating units were divided into 21 groups of three units connected in series. With heaters rated 1250 watts at 110 volts, but connected in series of three to 208 volt current, the total capacity of the system was reduced from rated 79 kw. to 31 kw. The 21 groups of three were furthermore subdivided into 3 groups, and leads of each group (six leads in all) were carried out to the control panel, where the star or delta connections of the three phase current can be made by a hand-operated double-throw knife switch. In this way 31 kw. current is used during



Details of heat treating furnace installed at the Edo plant working hours and 18 kw. at night. In either case the uniform temperature of the furnace is maintained by switching the current on and off by the controlling pyrometer.

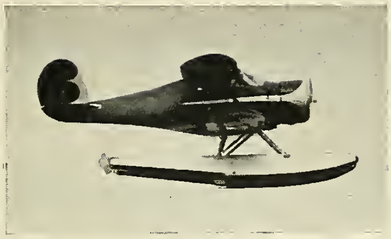
Tests on the rate of cooling and heating have shown that maintenance of a uniform temperature of 950° F. requires an average current consumption of 7 kw. when the cover is closed and no work is put into the furnace. In working hours, frequent opening of the cover and putting in of the parts to be heat treated raises the mean current consumption to 16 kw. It will be noted that in either case the available capacity of the heating elements is about 100% in excess of the average heat used.

Anodic Oxidation

The anodic oxidation treatment is the method of corrosion protection of aluminum alloys by forming a film of aluminum oxide on the surface. This method has a close analogy in the case of copper, in which corrosion resistance is obtained by a thin but dense film of oxide which forms on the surface and protects the metal against further action of oxygen. A similar film of oxide is formed on the surface of aluminum alloy for protection.

Under ordinary conditions, aluminum oxide is not formed as a continuous and dense film, but in scattered porous spots which afford no protection to the metal. On the other hand, it was found that a thin and dense film of aluminum oxide is formed if the oxygen is deposited on it electrolitically at a sufficiently rapid rate. This is accomplished by placing the metal in a chromic acid bath and connecting it to the positive lead (anode) of the direct current supply, while the negative lead (cathode) is attached to the steel tank.

The electric resistance of the chromic acid bath is low and when the clean aluminum alloy sheet is placed in it, voltage has to be kept as low as 3 volts to keep the amperage within reasonable limits. As the film of oxide begins to form it acts as an insulator, requiring a gradual increase of voltage for maintenance of essentially constant amperage. In this way, voltage is built up to 40 volts in approximately 15 minutes, and is so maintained for 30 minutes. After this, the parts are removed from the bath and are thoroughly washed to remove chromic acid.


Edo all-metal float-equipped Beechcraft

Chromic acid is used merely as a carrier of the electric ions and has no chemical action on the metal, being chosen primarily because of its neutrality to aluminum. It is possible to oxidize the aluminum alloy in a bath of sulphuric acid, but the film of oxide formed is not so uniform and dense, and occasionally breaks under electric potential, thus pitting the metal. For this reason, care must be exercised to eliminate all traces of sulphuric acid from the anodic bath. Likewise, the choice of the voltage variation from 3 to 40 volts, resulting in current density of 2 to 4 amperes per square foot of surface, and the concentration of chromic acid from 3 to 10% by weight were determined purely experimentally to give best quality of the oxide film. The temperature of the bath has a marked effect on electrical resistance of the oxide film. The bath has to be maintained at temperatures from 102° to 106° F. A cooler bath results in lower current, resulting in the deposit of an inferior film of oxide, while the hotter bath increases the current to the point where it may break the resistance of the film and cause pitting.

Tank Specifications

The welded steel tank, measuring 6′ wide, 4′ deep and 30½′ long, contains 5000 gallons of chromic acid. It rests on two layers of insulating brick, and the ends of it are covered by insulating blocks, protected by sheet steel covers. The back side of the tank comes within 4″ of the wall of the building and this space is filled with insulating powder. Clamped on the front side of the tank are 78 chromalox strip heaters with a total capacity of 87 kilowatts. Heaters are covered by insulation and steel covers, and in this way being protected from accidental damage as well as from acid splash.

Inside the tank are two piping systems. Along the rear side are several turns of iron pipe through which cold tap water can be circulated for cooling the tank. Near the front wall at the bottom is the perforated iron pipe through which compressed air can be passed. This air bubbles through the acid and helps stir it, a necessity which has been emphasized by the originators of the anodic oxidation process and by early experimenters who worked with small tanks. It was found that with the large size tank the convection currents set up during the heating period, and the circulation caused by liberation of the oxygen at work and of double amount of hydrogen at walls of the tank, maintain adequate circulation.

A Ford equipped with Edo floats

Preheating of the tank is necessary before the process starts, but during the process excess heat is generated by the current passing through the bath and the oxidation so that cooling is necessary. The arrangement of all heating at the front wall of the tank, and of all cooling at the rear wall maintains active convection circulation.

When the tank is not in use the top is closed by a wooden cover made up of two layers of 1½″ boards which effectively prevent loss of heat. This cover is hinged at the rear wall of the tank and is opened by a hand winch. The size of the tank combined with careful insulation prevents rapid changes of temperature which would impair the quality of the work. The insulation also prevents heat loss when the tank is not used. If it is in daily use, it takes only one hour of heating to bring it up to the correct temperature for work in the morning, (the heat supply of 310,000 B.T.U. as against the total of 1,700,000 B.T.U. which are needed to heat it from 60°F. to 104°F. initially). This means a heat loss of only 18 percent in 16 hours.

The work to be treated is attached by aluminum strips to the horizontal steel gate which is suspended from trolleys travelling on rails at the ceiling from one side of the room to the other. The gate is suspended so that it can be raised or lowered by a hand winch. When the treatment is completed, the gate is raised so that all parts are above the tank; it is then moved to the opposite side of the room over the washing trough, and is lowered again so that parts can be washed by hose.

Current for the anodic treatment is supplied at present by a motor generator set of 25 h.p., but provision is made for installation of a 100 h.p. set if needed, and all wiring is based on the larger power. The necessity of fine voltage regulation necessitated the use of an additional ½ kw motor generator for excitation for the field of the main generator. This auxiliary generator is shunt wound, and the rheostats are provided both in the field of exciting generator, and in the field of the main generator, giving a wide range and sensitivity of regulation. The generators manufactured, by the Continental Electric Co., have both motor and generator armatures mounted on the single shaft running in two ball bearings, thereby reducing dimensions, weight and cost.

Factory Procedure in the Fabrication of All-Metal Aircraft

Modern Methods Followed by one of the Largest Aircraft Producers

●

F. P. LAUDAN
Factory Superintendent
Boeing Aircraft Company

Production progress chart for entire factory organization

● Cost and complexities of aircraft manufacture increased substantially when those who had been satisfied with wood and fabric for their products turned to the almost exclusive use of metal. Advantages of the change were obvious and the aeronautical engineer did not hesitate to seek them out. Yet to those directing manufacturing activities, the move—however progressive—meant radical and expensive alterations in equipment and methods.

It is to the credit of the industry as a whole that the forward step was taken, despite increases in overhead and in the face of numerous new production problems. The results, as illustrated in the all-metal airplanes which today are standard equipment of the commercial airlines and the military services, admittedly have been worthwhile.

It is not the purpose here to describe the many changes which took place in the transition from the stick and wire airplane to that of all-metal construction so much as to deal with equipment and methods as they are to be found at present in the plant of a representative commercial and military aircraft builder.

The Boeing Aircraft Company of Seattle, whose early success was based on wood and fabric planes, was one of the first to turn to metal. The initial step was from stick and wire construction to the welded steel tube structure. After that, in the order named, came the combination welded steel tube and bolted duralumin tube structure, the complete bolted or riveted dural tube structure and, finally, the complete all-metal semi-monocoque type of plane.

As examples, the first Boeing-built pursuit of 1922, known as the MB-3A, was of typical stick and wire construction; the company's PW-9 pursuit of 1925 had a welded steel tube structure; the F2B-1 Navy carrier fighter of 1926 was of welded steel tube and bolted dural tube construction, and the first P-12 pursuits and F4B carrier fighters had complete bolted or riveted dural tube structures. The change to all-metal semi-monocoque structures occurred in the Boeing P-12E pursuits and F4B-4 fighters, although wood and fabric wings still were used. Complete metal construction came in the Boeing Monomail of 1931, which ranked as the first successful smooth-skin commercial transport with retractable landing gear.

Latest military monoplane, the Boeing 299 bomber

Substantially the same type of construction as that used in the Monomail has been employed in succeeding Boeing commercial and military planes. Outstanding examples have been the company's Model 247-type transports, the single-seater P-26A pursuits attached to United States Army Air Corps bases over the country, and the four-engined Boeing 299 bomber which came out last August as America's largest landplane and the fastest, longest-range bomber ever built.

Changes within the aircraft factory have been just as sweeping as those in the types of construction. Activities of certain branches of the plant have diminished; those of others have grown. Wood working tools have been replaced, to a large extent, by riveting guns, metal drills and metal working machines. New methods and new processes have been developed to keep pace with the transition.

Long before a new design has been completed by the engineering department, the purchasing department has been estimating and tabulating material requirements. Materials not already on hand must be ordered so that they will arrive as needed—not oversoon and not a moment late.

With drawings completed, the production office swings into action. Tools must be planned and timed to meet materials and parts; the routing of parts through the various shops must be scheduled; shop orders for the fabrication and processing of parts must be prepared and issued to each shop affected; a complete date for each part must be established and shown on each shop order, and a constant check must be maintained to insure that parts are progressing according to schedule. All in all, intelligent planning to a nicety is required to guarantee that there will be no waste motion, no unnecessary overhead and no hitch in the production program.

Duralumin has been the material chiefly used in Boeing all-metal construction, but not to the exclusion of others. In the case of the Model 247-type transports, for example, chrome molybdenum seamless steel tubing was used for the landing gear, engine mount, tail wheel and inboard spar chords; aluminum for fuel tanks; stainless steel for exhaust stacks as well as for ball and roller bearings; bronze, to some extent, for bushings, and steel or bronze for gears, pinions and worm drives used in the landing gear, tail wheel and controls.

Metal-Working Machinery

Issued on requisition by the receiving store, slab and bar stock goes to the machine shop where there are batteries of lathes, shapers, milling machines, grinders, drill presses and other such equipment. Included are one of the largest turret lathes in the Pacific Northwest—a 4-A Warner & Swasey weighing 15,500 lbs. with a 28½-in. swing and a 7½-in. × 5-in. bar capacity; a Carlton radial drill of the power traverse type with a 4-in. arm and 11-in. column, and a No. 3 Cincinnati dial type vertical milling machine with a power feed and rapid traverse. Manning these machines are skilled mechanics who not only must work to exceedingly close tolerances but who must be thoroughly familiar with the characteristics of all the different types of metals which they are called upon to handle.

On its issuance by the receiving store, sheet metal passes directly to the primary shop for cutting to size and shape. If further fabrication is needed before subassembly, it then proceeds either to the sheet metal, drop hammer or welding shop, depending on the type of work required.

Beginning assembly in a cradle jig where parts are located for drilling

In the primary shop are punch presses, square shears, rotary shears, vertical spindle shapers and a draw bench. Here parts are cut to size and shape from full-size metal templates made by the engineering department. All main bulkheads, compression ribs and ribs are so templated.

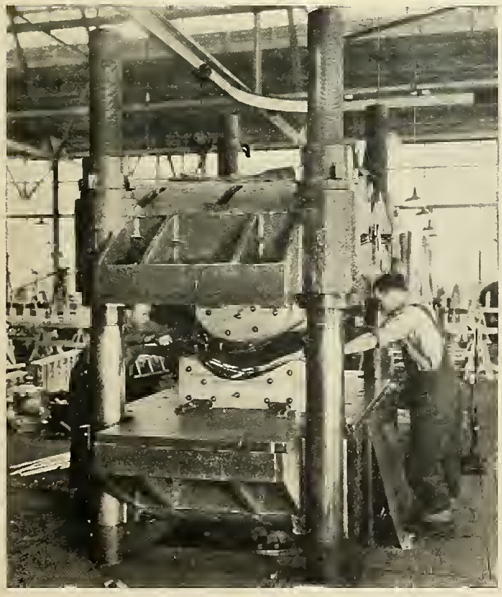
Templates used are three-quarter hard aluminum, .040″ in thickness. These are painted flat white with penciled outlines for experimental planes and with the outlines inked in and fixed with lacquer for production work.

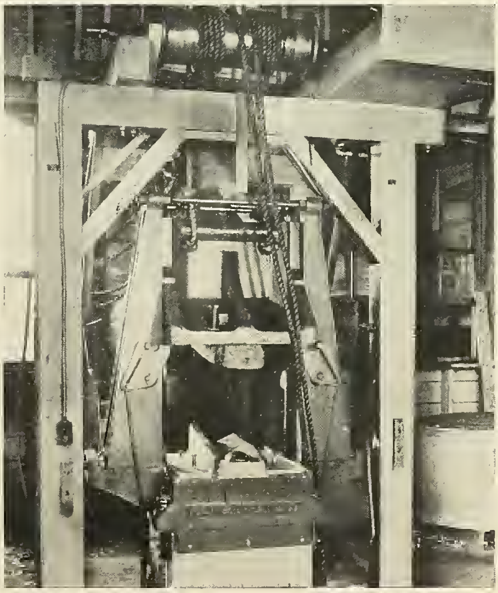
On the templates are all rivet and bolt locations, controlling center lines and outlines of major members and fittings. A No. 60 drill hole is used to transfer locations through the template to the actual work. In the case of large planes, one-half templates are employed with different colors of ink to denote which parts are designed for the right and left sides of the plane.

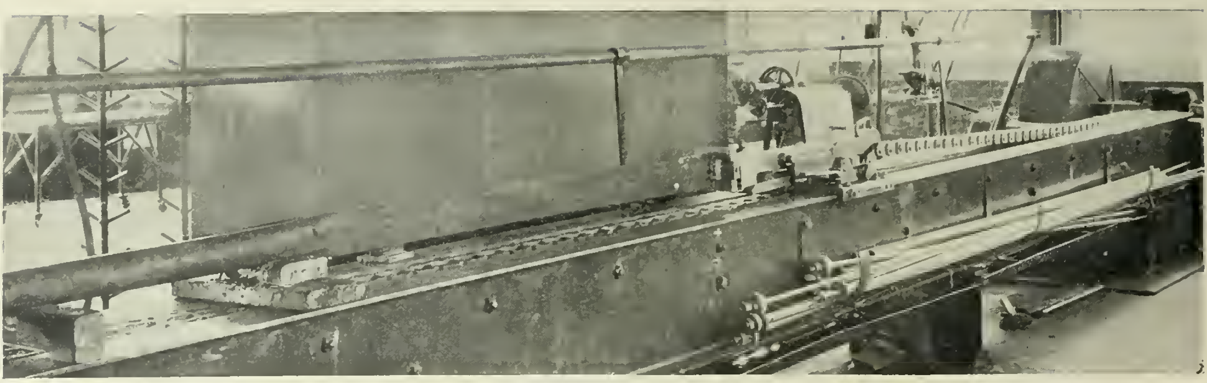
Templates and Drawing Work

It has been found that the engineering department can make such templates far more accurately than the shop layout men and, in so doing, can study the construction of joints, lapping of sheets, offsets and fittings, spacing of rivets and bolts, etc., with resultant savings in both material and time.

Where considerable lengths of the same section of stock are required, the primary shop uses its draw bench. Flat sheet, drawn by a moving carriage on an endless chain and passing through two sets of dies held in a vise, is formed into virtually any shape of channel section


Hydraulic press having 700 tons pressure, for heavy sheet aluminum parts


One of the drop hammers for forming smaller sheet metal in wood or steel dies



Drawbench which forms long lengths of sheet and tubing into desired shapes

desired. Tubing is similarly formed into square, rectangular, oval or streamlined shapes. Sheet metal of from .016″ to .091″ in thickness and tubing from .035″ to .250″ in wall thickness have been handled in this manner.

The Boeing company's hammer shop has charge of all work done by the drop hammer and hydraulic press method. There are three drop hammers—large, medium and small, and two hydraulic presses—one of 700 tons pressure and the other of 50 tons. Operation under the hammer is one of compressing the metal with a series of sharp blows, whereas that in the hydraulic press usually is one of stretching. Generally speaking, far more difficult forming operations can be accomplished by the hammer method, although each device has its important use in the forming of aluminum alloy materials. Wood and steel dies are used in the presses, while lead and zinc dies made from molds are employed under the hammers. It might be mentioned here that dies used by the Boeing company, whether in the hydraulic presses, drop hammers or draw bench, are designed and made in the company's own shops.

The tensile strength of both duralumin and steel for Boeing planes is more than doubled by heat treating. The dural heat treating room is equipped with two salt bath tanks, internally fired by gas; a cold water quench tank and a hot water rinse tank. In the steel heat treating room are three pot-type furnaces, gas heated, and three electric furnaces for larger parts, as well as a number of pot furnaces for smaller parts.

Dural is treated in a molten salt solution kept at a temperature of 950° F. for from 12 to 22 minutes, depending on its thickness. It then is dashed into cold water and run through the hot water rinsing tank. Approximately 78 hours are required at room temperature for the metal to age to its full strength, after which it is Rockwell tested to make certain that it comes up to specifications. By such methods, tensile strength is increased from 26,000 lbs. to 55,000 lbs./sq. in.

Duralumin rivets must be given special handling after heat treating, since their aging must be retarded until they can be used. To accomplish this, they are placed in dry ice containers at sub-freezing temperatures. From these containers they are distributed as needed to riveters about the shops. Those rivets so distributed and exposed to room temperature for 15 minutes without being used are picked up and returned for re-heat treatment. Such is just one detail of care in building all-metal planes, and, considering the fact that the Boeing company has used as many as 62,000,000 rivets in one year, not a small one!

Methods of heat treating steel are, of course, somewhat different from those adopted for dural. Pot furnaces are used for such small parts as bolts, shackles. clevis ends and terminals. One is employed for quenching. In this, the molten salt is kept at a temperature of 1625° fo chrome molybdenum parts which are left in the furnace for from 15 to 25 minutes, then are removed and quenched in an oil bath.

After quenching, parts are placed for from 15 to 25 minutes in another pot furnace equipped for drawing. In this the molten salt bath is maintained at a temperature of from 600° to 1150°, depending on the physical properties desired. Following this treatment, parts are allowed to cool in the air, water or oil, according to the type of material.

There also is a pot furnace used for cyanide hardening of small carbon steels requiring a hard skin. In this, the bath is kept at a temperature of 1500°, with parts subjected to this heat for from 30 minutes to one hour.

The three electric furnaces of the steel heat treating room are used for both quenching and drawing, with the temperatures in these being run up as high as 1800°.

Both the oxy-acetylene torch and the electric arc have their place in the Boeing

Machine shop where parts are made of slab and bar stock

The tanks in which finished aluminum parts are put through anodic process

company's welding shop. Parts handled here include engine mounts, spar joints, landing gear treadles, exhaust stacks, tail wheel treadles, joint fittings and any number of smaller items. The electric arc generally is employed wherever there are wide variations in the thickness of material, while the torch comes into play where sections of material are of equal thickness and where parts are sufficiently small to be handled on the welding shop benches.

In the sheet metal shop, parts are formed and assembled in jigs before progressing on to other shops. The latter include such divisions as the control surface shop which occupies itself with rudders, elevators, fins and stabilizers; the wing shop, concerned entirely with the assembly of all-metal wings, and the body shop, which, as its name implies, handles all body assemblies.

A common meeting place for all parts, at one stage of production or another, is the finishing shop. Under the present system, this branch of the factory not only has charge of applying primer and finishes but also supervises the important cadmium process for steel and the anodic process for aluminum and aluminum alloys.

Both the cadmium and anodic processes have a similar purpose—to protect parts from corrosion. Cadmium plating facilities include metal cleaning tanks, pickling tanks, rinse tanks, neutralizing tanks and an 1800-gallon plating tank. The anodic treatment room houses cold and hot water rinse tanks and two treating tanks, each with a capacity of 2200 gallons. Direct current for the process comes from a generator developing up to 65 volts and 2000 amperes.

All steel parts for Boeing planes go through the cadmium process, which is nothing more nor less than electro-plating. Duralumin and aluminum parts go through the anodic process, which is something the reverse.

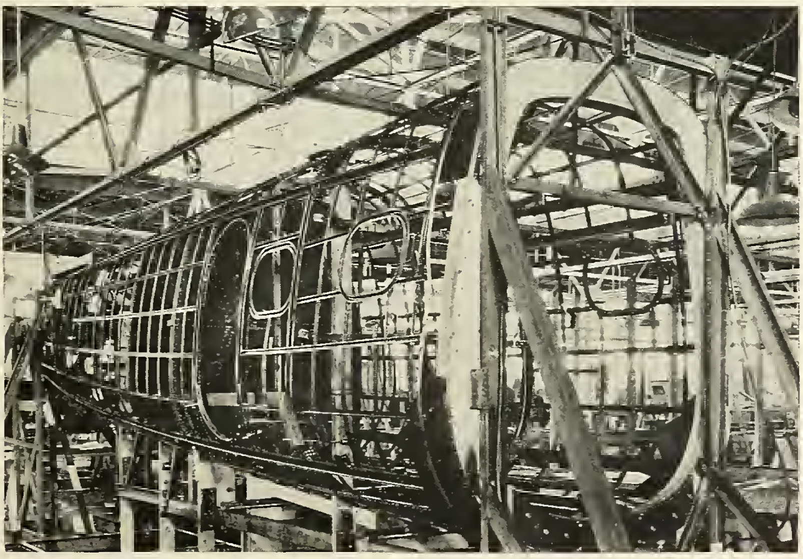
Parts to be anodized are suspended in a chromic acid solution. Current from the generator, passing through the metal and the solution, is stepped up from zero to forty volts at the rate of five volts increase per minute and is held at forty volts for a period of 30 minutes. Amperage varies entirely as the load of surface area in the bath. The result of the treatment is artificial oxidation, imparting to the metal a high degree of resistance to the corrosive action of the elements.

The Boeing company first used the anodic process only for duralumin parts going into Navy planes. It proved so successful, however, that it subsequently was adopted for duralumin and aluminum parts going into all commercial and military planes. In the case of the Model 247-type transports, the outer skin of the planes was left in its anodized state, without use of exterior finish, thus permitting a saving in weight. The color is called anodic gray, and closely resembles a light battleship gray.

Parts and sub-assemblies coming from the various shops proceed to the assembly shop where planes take final form. Here body sections are brought together, engines are installed, landing gears are added, wings are attached, cable work is completed and interior details are finished.

Throughout the Boeing shops, quality of workmanship is the paramount consideration. Not only are expert craftsmen employed but their work constantly is being checked by inspectors. From the time stock is received until it takes to the air, it is being subjected to the unceasing vigilance of those specialists whose job it is to guarantee quality regardless of cost.

Such is the picture of a representative aircraft manufacturing plant in these days of all-metal construction. New machines and new methods have come; many of the old ones have disappeared entirely. It is another chapter in the history of an industry which always has and always will take the progressive step.



Rear section of Boeing transport being assembled in steel jig

EDITORIALS

"Paraphrasing O. O. MacIntyre's 'Thoughts while Strolling' a good inscription for an aviation memorial for Will Rogers: To Will Rogers whose spirit of courage, faith and sympathetic understanding will forever continue to travel the airways of the world as an inspiration to greater accomplishment and greater achievement."—COL. CLARENCE YOUNG, Manager Pacific Division, Pan American Airways.

Accord in Transatlantic Air Service

● Sixteen years ago two courageous and determined pilots, Captain John Alcock and Lieutenant Arthur Whitten Brown, set out on one of the most daring flights ever attempted, the non-stop crossing of the north Atlantic Ocean. Today preliminary preparations for the establishment of regular services across that same ocean have been completed.

Following conferences in Washington between representatives of the United States and Great Britain, Canada and the Irish Free State, two routes were selected. The northern (and shorter) route will extend from New York to Newfoundland and Ireland and the southern route will be via Bermuda and the Azores, both following practically identical paths predicted by Captain Frank Courtney in an article in the August, 1931 issue of AERO DIGEST.

Noteworthy at the conference was the cooperation between conferees in the removal of obstacles on reciprocal landing and operating privileges. Until now Great Britain denied such privileges to foreign countries in Bermuda. Now the airliners of the United States will be permitted to land there, in Canada, Ireland and Great Britain. Great Britain, in return, is offered landing facilities here.

An interesting development was the acceptance of American flying boats as the equipment with which to fly the Atlantic route, admittedly a more hazardous passage than the Pacific. If any evidence of superiority in aircraft was needed, the ready acceptance of our machines by the British is a convincing indication of the fact that we lead the world in flying boat design.

Aircraft Engine Development

● Progress in aviation has always been gauged largely by improvements in the design and manufacture of the engine. Therefore it is necessary to support and encourage the development of engines in whatever field an apparent demand exists. The fact that the American aircraft engine manufacturer has done little in the way of new development work in the past three years is evidenced in the record of approved type certificates.

We neither attempt to present an explanation for this situation nor to condemn or excuse our apparent laggardness in this highly important branch of aviation development.

There are some who may say that economic conditious preclude the possibility of making further progress with ideas or designs that remain in various stages of development. But, the depression has been world-wide, so that explanation does not seem to satisfy entirely.

Attention has been directed to the lack of competitions of the sort that provide real incentive to develop special engines, so perhaps our race committees might give that idea careful deliberation.

With regard to engines suitable for military service, which takes in a rather extensive horsepower range, we are faced with the fact that European countries, generally, have been appropriating larger sums for the development of aircraft. Perhaps, then, our military services have displayed wisdom in the spending of the limited funds available; that is, by expending the necessary amount on those engines needed most in order to insure their refinement, rather than encourage the construction of a number of types, for which there obviously would not be sufficient funds to guarantee completion or satisfactory development.

Stricter Control of Illegal Flying

● Regulations of the Bureau of Air Commerce were promulgated to enhance aerial safety, yet an alarming number of students, amateur and other pilots who lack experience in the air, have been taking passengers for hops, and getting away with it until the inevitable accident happens.

There is far too much of this dangerous violation going on. In two years 83 accidents, in which passengers were carried by student or amateur pilots, have been reported. 31 have been fatal to pilot or passenger or both.

Some means must be found to impress upon the embryo pilot the harm he does by flagrantly disregarding regulations intended to protect him as well as the industry.

Revocation of licenses and criminal prosecution are means for dealing with violators after they break regulations, but there must be some control before they attempt illegal flying. A suggestion in Roosevelt Field *News* is worthy of consideration. It asks all pilots to discourage such flying by reporting violations by those who break this law.

Nineteen Thirty-Six! A New Plane Year

● The industry looks to 1936 with hopes born of optimism. Perhaps it is the fact that aeronautical factories were working overtime to catch up with orders, or that student registrations reached an all-time high of 24,000. Maybe its optimism is a reflection of the tremendous traffic carried by our airlines in 1935.

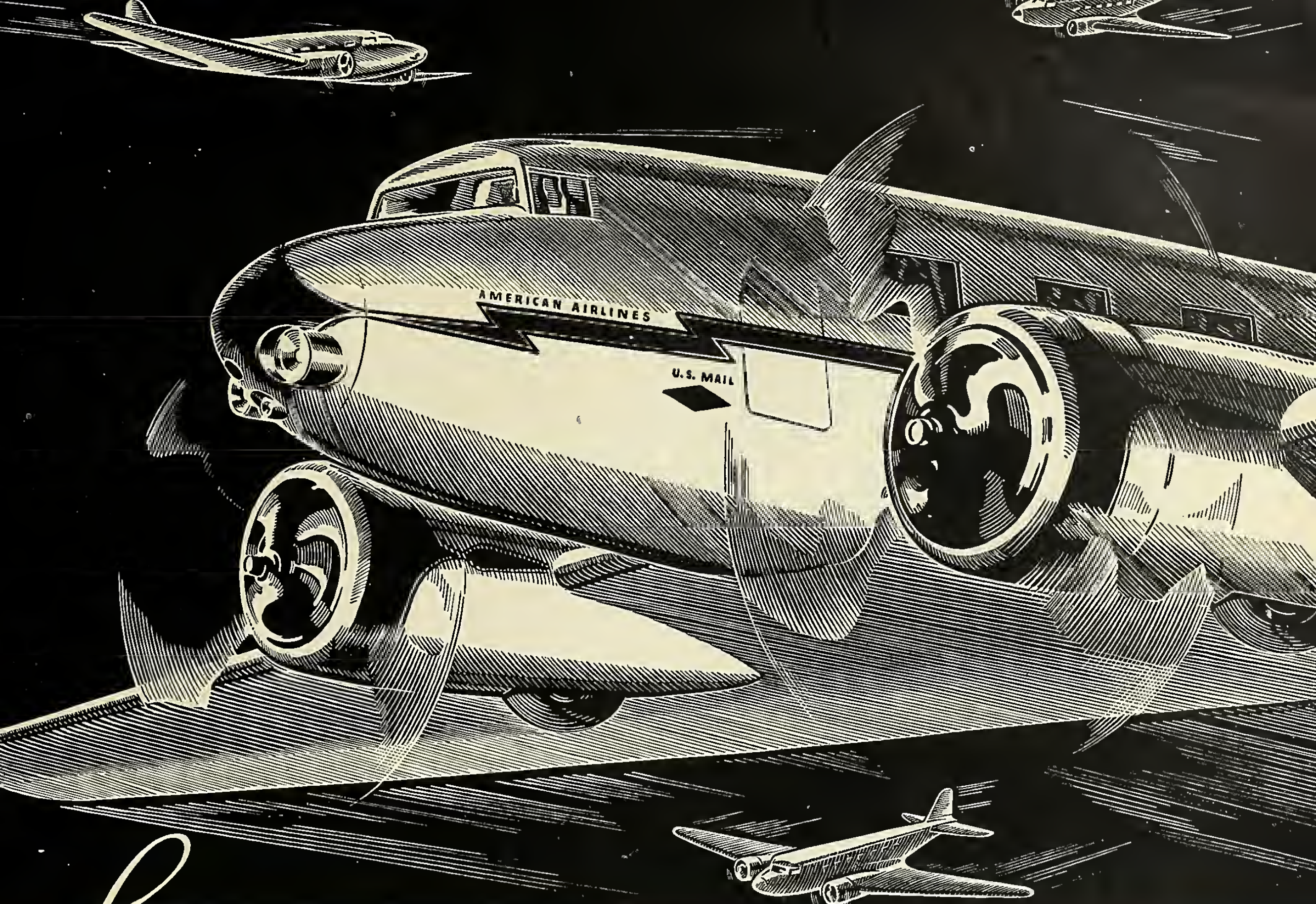
The airlines have educated, and are continuing to sell, a large number of people on the benefits and pleasures of air travel. However, a great many individuals who can afford to do so will want to fly their own planes.

Fear of flying is appreciably reduced as people become more accustomed to see the flying machine in greater numbers and because it is recognized that the airplane, itself, is safer. There are more usable airports, better and improved flight instruments, and more efficient radios available for safer navigation.

About 75 percent of the airplanes licensed today are more than four years old, and many owners have been content to get along with their older models during the depression. With the advent of better times, these owners naturally realize that it is desirable to dispose of their antiquated planes in favor of newer models, the reliability of which is greater, and which offer proven safety devices such as flaps, plus greater speed, more comfort, lower operating costs and better styling.

Too many airplanes in service today are entering their fifth and sixth year. There is always an economical point at which to trade in used equipment. Generally, an airplane five years old can be sold without making necessary repairs and replacements. If it goes into its sixth year, however, the chances are that considerable work will be necessary, and the buyer of this type of used plane does not desire to make much cash outlay, because he knows he may have to spend a large sum for repairs before the plane can be used safely.

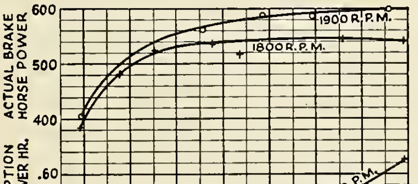
Wise pilots will be getting rid of their five-year-old airplanes; with trade-in allowances right, many owners of three- and four-year old planes will be flying 1936 models in comfort and safety; and with greater airmindedness growing out of actual use of the airliner together with the fact that comparatively little airplane buying has been experienced during the 3 years past—1936 should be "a new plane year."



Low FUEL CONSUMPTION *with* ADVANCED CYCLONES

Lower fuel consumption now supplements the recognized low maintenance costs of the Wright Cyclone—established by 550,000 hours of airline operating experience. Continual refinement in the design of the standard Cyclone has reduced fuel consumption to the lowest values ever obtained in flight operation with an established air-cooled engine.

The curves illustrate a flight demonstration of the extremely low fuel consumption characteristic of the Advanced Cyclone. These results were obtained by flying at constant throttle and progressively leaning the mixture strength. No detonation resulted, and head temperatures never exceeded 405° F.



on a warm September day. A cruising-power fuel consumption of no more than .42 lb. per brake horsepower hour was easily obtained and some readings were even lower—a record low consumption for a standard type of gasoline engine.

This outstanding performance was obtained by using regular 87 octane gasoline without any special equipment except the Cambridge mixture indicator which was introduced last year by Wright engineers to assist operators to obtain the best fuel economy. The test typifies the advanced engineering which has produced the world's leading aircraft engine — the WRIGHT CYCLONE.

WRIGHT

AERONAUTICAL CORPORATION
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Chronology of Some Important Events in 1935

● Air transport operators in 1935 gave the country its greatest aerial accomplishment since the airplane became part of our transportation system. Passenger, mail and express traffic were at new highs, schedules quickened, equipment improved, and safety and dependability were an accepted achievement. Trans-Pacific service was inaugurated, and plans were formulated for a similar project across the Atlantic.

New commercial airplanes, higher horsepowered and more efficient engines and equipment made their debuts. Among the outstanding developments were the Martin flying boats for Pan American Airways, the Sikorsky S-43 amphibion, the constant speed propeller, the dynamic damper, and the radio compass. Manufacturers of private craft consolidated their position by a steady influx of orders and prepared for an even more promising 1936 by engineering new and improved products. Larger and more comfortable transports will make their appearance in 1936 as well as new twin-engined craft designed for fast, feeder-line service.

New military developments showed our continued supremacy in aerodynamical advancement with such machines as the Consolidated XP3Y-1, Curtiss SOC-1, and Vought SBU-1 for the Navy, and the Boeing 299 bomber and Consolidated amphibion for the Army. Numerically, military aviation remained inferior to other major air powers, but orders for new planes placed just as the year ended showed government recognition of this and further appropriations for a widely expanded and better-equipped air force are expected.

1935 witnessed the ascendency of the United States to leadership in world aeronautical records as noteworthy speed, distance and altitude flights claimed the attention of the world. The following digest of aviation events, which includes only a cross-section of the more outstanding occurrences, will serve to show the general trend of aeronautical progress during the year.

January

The Pan American-Grace Douglas *Santa Lucia* flew between Mendozan and Buenos Aires in 3 hrs. 20 min., averaging 189.5 m.p.h., establishing a record . . . . (Jan. 3)

The All-American Air Races were held at the Miami, Fla., Municipal Airport . . . . (Jan. 10-12)

Arthur Chester set a world speed record at Miami, Fla., for light planes in the second category attaining 222.863 m.p.h. at Miami, Fla., in a Menasco-powered Chester Special . . (Jan. 11)

Amelia Earhart made the first eastward solo flight across the Pacific Ocean in a 550 h.p. P. & W. Wasp S1D1-powered Lockheed Vega, flying from Wheeler Field, Hawaii to Oakland, Calif., in 18 hrs. 16 min. . . . . . . (Jan. 11-12)

James Doolittle flew a Wright Cyclone-powered Vultee from Burbank, Calif. to Floyd Bennett Field, N. Y. in 11 hrs. 59 min., a transport plane record . . . . (Jan. 15)

Helen MacCloskey and Genevieve Savage, a passenger, set a world speed record for women at Miami for light airplanes in the first category flying 166.632 m.p.h. in a 145 h.p. Warner-Scarab-powered Monocoupe . . . (Jan. 15)

Madeline Charnaux and Mlle. Clarck set a women's world altitude record at Orly, France, for light airplanes in the first category reaching 20,062.275 ft. in a Renault-powered Farman . (Jan. 29)

Harry Richman set a world altitude record at Miami, Fla., for amphibions attaining 18,641 ft. in a Sikorsky S-39. (Jan. 29)

February

Harry Richman and George Daufkirck set a world speed record at Miami, Fla. for amphibions flying 99.945 m.p.h. in a P. & W. Wasp-powered Sikorsky S-39. . . . . (Feb. 10)

The airship U.S.S. *Macon* was destroyed off the California coast near Point Sur when a broken fin caused a landing in the water . . (Feb. 12)

An Eastern Air Lines Douglas flew from Miami to Newark in 5 hrs. 34 min. carrying 13 passengers at an average speed of 215 m.p.h. . . . (Feb. 17)

Paul Codos and Maurice Rossi flew non-stop 3100 miles from Istres to Porto Praia, Cape Verde Island in the Hispano-Suiza-powered Bleriot *Joseph Le Brix*. . . . . (Feb. 17)

Wiley Post started experimental test flights in the sub-stratosphere, flying his P. & W. Wasp-powered Lockheed Vega *Winnie Mae* for 2 hours at 28,000 ft. averaging more than 300 m.p.h. (Feb. 17)

Leland S. Andrews flew a Wright Cyclone-powered Vultee from Burbank, Calif. to Floyd Bennett Field, N. Y., in 11 hrs. 34 min., a transport plane record . . . . (Feb. 21)

March

Leland S. Andrews set a record when he flew a Wright-powered Vultee transport with five passengers from Los Angeles to Mexico City in 8 hrs. 9 min. . . . . (Mar. 6)

Wiley Post flew in the stratosphere from Burbank, Calif. to Cleveland in 8 hrs. 4 min., in the *Winnie Mae*, to set a record . . . . (Mar. 12)

A Pan American Airways' Sikorsky S-42, powered by four P. & W. Hornet engines, flew a non-stop round trip between Miami and the Virgin Islands, to set a seaplane distance mark of 2504 miles . . . . (Mar. 23)

Eugene Stüber and Werner Schaefer flew the balloon *Leipziger Messe II* from Bitterfeld, Germany to Pozariche, Russia, setting a world balloon record of 747.880 miles . . . . (Mar. 25-26)

L. J. Burzynski set a world altitude record for balloons in the 3001-4000 cubic meter class by climbing 30,994 feet over Legjonowo, Poland . (Mar. 28)

April

Wiley Post's third sub-stratosphere flight was between Burbank, Calif. and Lafayette, Ind., in 8 hrs. 12.5 min. at an average speed of 231.48 m.p.h. (April 14)

The first experimental flight across the Pacific Ocean was made by Capt. Edwin Musick and a crew of five in a Pan American Airways' Sikorsky S-42. The westward flight was from Alameda to Honolulu and required 17 hrs. 45 min., setting a speed record. The eastbound trip took 20 hrs. 59 min. . . (April 17-24)

Jean Batten completed a round-trip flight from England to Australia in a Gipsy Moth, taking 14 days 23 hrs. 30 min. for the westward journey, a women's record. Her round-trip flight was the first accomplished by a woman (April 29)

The TWA Douglas DC-1, powered by two 710 h. p. Wright Cyclones, and carrying D. W. Tomlinson, pilot, F. R. Redpath, navigator and H. B. Snead, co-pilot set a world speed and duration record for a point-to-point flight in the second category. They took 11 hours 5 minutes 5 seconds for the flight. . . (Apil 30)

May

Amelia Earhart flew non-stop from the Texacoco Airport, Mexico City to Newark Airport in 14 hrs. 18 min. to set a record. Her plane was a P. & W. Wasp-powered Lockheed Vega. . .(May 8)

Major E. E. Aldrin established a record for twin-engined amphibions over a 100-kilometer course by flying the Stanavo Douglas Dolphin at 159.8 m.p.h. . . . . (May 15)

D. W. Tomlinson, pilot and J. S. Bartles, co-pilot flew the TWA Douglas DC-1 powered by two 710 h.p. Wright Cyclone engines to world records for speed over a 5000-kilometer course, (169.031 m.p.h.) and speed with a 500- and 1000-kilogram payload over a 5000-kilometer course (169.031 m.p.h.) . . . . (May 16-17)

Peter Dana set a junior transcontinental elapsed time flying record from San Diego, Calif. to Roosevelt Field, N. Y. in 33 hrs. 46 min. in a 125 h.p. Menasco Ryan S-T. . . . . . . (May 23)

June

The Pan American Airways' Sikorsky S-42 again flew the Pacific Ocean to Honolulu in 17 hrs. 57 min. and broke its record. Two days later it made the first flight to Midway Island. (June 13)

(*Continued on following page*)

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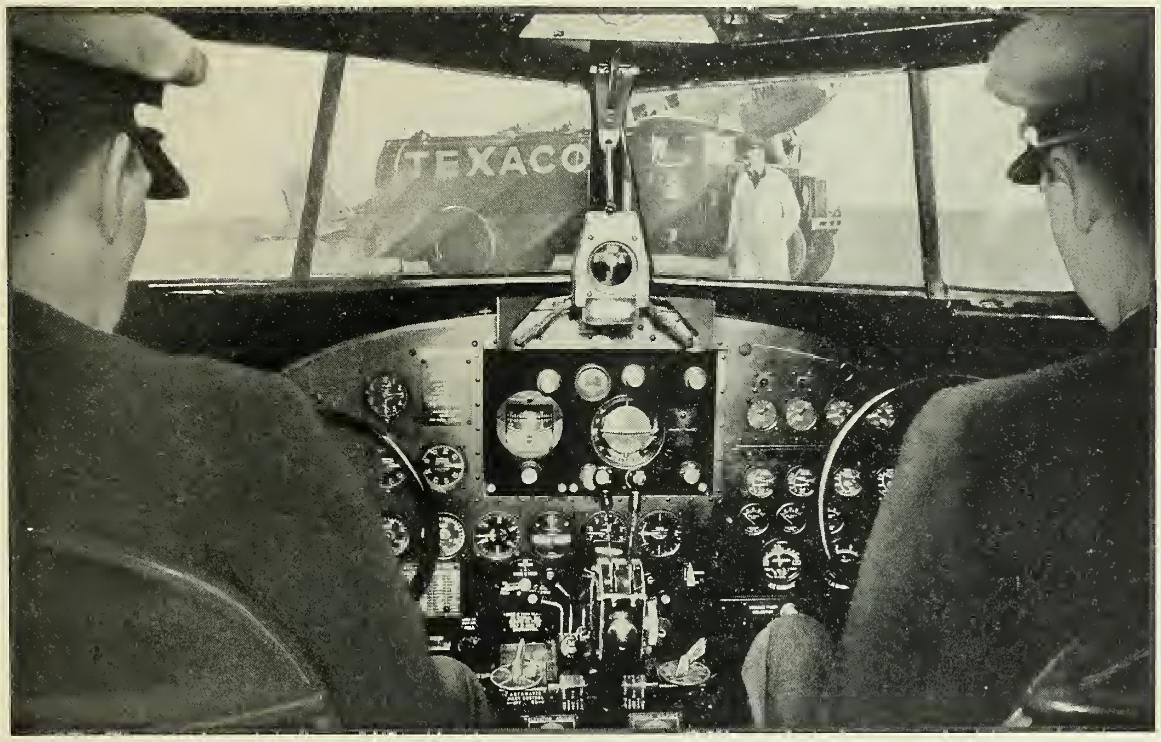

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(*Continued from preceding page*)

Benjamin King set a world airline distance record for light seaplanes in the third category flying an Aeronca-powered Aeronca for 185.398 miles. . . . . (June 16)

Marsye Hilz set a women's altitude record by climbing to 38,704 feet over Villacoublay. . . . . . (June 17)

A world's altitude record for women was established by Marquise Carina Negrone at the Montecelio Airport, Rome. She flew a Pegasus-powered Caproni 113R to 39,511.035 ft. . . (June 20)

Lieut. de vaisseau Hebrard and Lieut. de vaisseau Daillaire set a world's broken line distance record for seaplanes by flying a 2600-h.p. Hispana-Suiza four-engined Latecoere flying boat from Cherbourg to Ziguinchor, a distance of 2764.-847 miles. . . . . . (June 22-23)

Lieut. Richard L. Burke set a world record for amphibions for speed over a 100-kilometer course in a Wright-powered Grumman at 173.945 m.p.h. . . . . (June 23)

Benjamin King set a world airline distance record for light seaplanes in the second category by flying an Aeronca-powered Aeronca for 219.959 miles. . . . . (June 25)

Lieut. Richard L. Burke set a world altitude record for amphibions while carrying a 500-kilogram payload. His plane, a Wright-powered Grumman attained 17,877.242 ft. . . . (June 27)

The Sixth Annual National Soaring Contest started at Elmira, N. Y. under the auspices of the Soaring Society of America. . . . . (June 29)

July

Al and Fred Key set a world endurance record by remaining in the air over Meridian, Miss., for 653 hrs. 34 min. in the Wright Whirlwind-powered Curtiss Robin *Ole Miss*. . . . . . (July 1)

Maurice Arnoux and Mme. Becker set a world speed record for the 1000-kilometer course for light airplanes in the first category. They flew a Renault-powered Caudron Rafale at 181.952 m.p.h. . . . . (July 7)

Laura Ingalls made the first women's non-stop flight from Floyd Bennett Field, N. Y. to Burbank, Calif., in 18 hrs. 19.5 min. in a P. & W. Wasp-powered Lockheed. . . . . (July 11)

The Sixth Annual National Soaring Contest was concluded at Elmira, N. Y. Ninety-six pilots with 40 gliders attended the meet. . . . . (July 14)

Mariano Stoppani and Casimiro Babbi set a world seaplane record by flying a Cant. Z 501 seaplane powered by a 750 h.p. Isotta-Fraschini Asso engine from Monfalconi to Berbera, 3103 miles. . . . . (July 16-17)

The All-American Aircraft Show, Class C show, was held at the Detroit City Airport, Detroit, Mich. (July 20-28)

August

Maurice Arnoux and Mme. Becker set a world speed record for light airplanes in the first category over a 100-kilometer course. They flew a Renault-powered Caudron 450 at 281.942 m.p.h. (Aug. 8)

Maurice Arnoux set a world speed record for 100-kilometers, flying a Renault-powered Caudron at Etampes at 295.968 m.p.h. . . . . . (Aug. 10)

The Pan American Airways' Sikorsky S-42 made her third crossing of the Pacific Ocean from Alameda, Calif. to Honolulu, Hawaii and set a record of 17 hrs. 12 min. The plane continued to Midway Island and then flew on to Wake Island. . . . . (Aug. 10)

A four-engined Boeing bomber, powered by 700 h.p. P. & W. Hornet engines, flew non-stop from Seattle, Wash. to Wright Field, Dayton, in 9 hrs. averaging 233 m p.h. . . . . . (Aug. 20)

Raymond Delmotte set a world speed record for 1000 kilometers at Istres, in a Renault-powered Caudron C-460 which attained 279.948 m.p.h. . . (Aug. 24)

Brig. General F. M. Andrews set world speed records for seaplanes over a 1000-kilometer course without payload and with 500- and 1000-kilogram payloads. The respective records, made in a P. & W.-powered Martin bomber, were achieved at 168.034 m.p.h. . . . . (Aug. 24)

The National Air Races started at the Cleveland Municipal Airport. (Aug. 28)

Ben Howard won the Bendix Trophy race in his Howard DGA-6 powered by a P. & W. Wasp flying from Los Angeles to Cleveland at an average speed of 238.704 m.p.h. . . . . . (Aug. 28)

September

Harold Neumann won the Thompson Trophy Race at the National Air Races, Cleveland by flying the Howard DGA-6 *Mr. Mulligan* at 220.194 m.p.h. (Sept. 1)

Laura Ingalls set a women's transcontinental speed record by flying her 550 h.p. P. & W. Wasp-powered Lockheed Orion non-stop from Los Angeles, Calif. to Floyd Bennett Field, N. Y. in 13 hrs. 34 min. 5 sec. . . . . . (Sept. 12)

Howard Hughes set a world landplane speed record of 352.38 m.p.h. in a P. & W.-powered plane of his own design . . . . (Sept. 13)

Major Alexander de Seversky set a world speed record for amphibions at Wayne County, Mich. in a Wright-powered Seversky flying 230.03 m.p.h. . . . . (Sept. 15)

The James Gordon Bennett Balloon Race was held at Warsaw, Poland. The Polish balloon *Polonia II* landed 966.143 miles from the starting point to finish first. . . . . (Sept. 15)

Burzyniski and Wysochi flew the Polish balloon *Polonia II* to world records for duration and distance in the 5, 6 and 7th balloon categories. The respective marks were 57 hrs. 54 min., and 966.143 miles. . . . . (Sept. 15-18)

Lieut. Felix Waitkus flew from Floyd Bennett Field, N. Y. to Ballenrobe, Ireland in the P. & W. Wasp-powered Lockheed Vega *Lituanica II*. His time was 23 hrs. 15 min. . . . (Sept. 21-22)

Lieut. A. Biseo and G. Castellani set six world records for speed, and speed with payloads of 500-, and 1000- and 2000-kilograms, over 1000- and 2000-kilometer courses. . . . . (Sept. 23)

Benjamin King set a world altitude seaplane record for light one-place planes in the fourth category in an Aeronca which attained 15,082 ft. over Anacostia, D. C. . . . . (Sept. 24)

October

The Pan American Airways' Sikorsky S-42 completed her fourth record-breaking flight across the Pacific Ocean in 17 hrs. 5 min. . . . . (Oct. 6)

Lieut. Comdr. Knefler McGinnis and a crew of five set world records for seaplanes in the airline distance and broken line distance categories flying a P. & W.-powered Consolidated patrol boat 3,300 miles straight-line, and 3,450 miles broken line. . . . . . (Oct. 14-15)

Air Navigation Week was observed throughout the country and was featured by the visit of aeronautical delegates from Latin American countries and Canada. . . . . (Oct. 14-21)

Capt. Karl E. Gimmler won the Mitchell Trophy Race at Selfridge Field, Mich., averaging 212.9 m.p.h. in a P. & W.-powered Boeing P-26A. . (Oct. 20)

November

Capt. Albert W. Stevens and Capt. Orvil Anderson set an altitude record of 72,395 feet when they ascended in their balloon *Explorer II* from Rapid City, S. D., and landed at White Lake, 240 miles away after a 5 hour 5 minute flight . . . . (Nov. 11)

Jean Batten became the first woman to fly sole across the South Atlantic. She flew a Percival *Gull* from Dakar to Natal in 13 hours 5 minutes . . (Nov. 13)

Vladimir Konstantinovitch Kokinaki reached a height of 47,806 feet above Moscow in a stratosphere plane, a new unofficial altitude record . . (Nov. 22)

Pan American Airways inaugurated regular trans-Pacific service with the four P. & W. engined Martin flying boat, the *China Clipper* . . (Nov. 22)

December

The All-American Air Maneuvers were held at Miami, Fla. (Dec. 12-14)

Benjamin King set two world records for light seaplanes at Miami, flying his Aeronca seaplane at 70.48 m.p.h. over a 500-kilometer course, and 80.931 m.p.h. over a 100-kilometer course . (Dec. 11)

Tex Rankin set a U. S. altitude record for light planes, attaining about 20,000 ft. over Miami in a Menasco-powered Ryan S-T . . . (Dec. 14)

SKF-EQUIPPED
BUILT BY
GRUMMAN AIRCRAFT
ENGINEERING CORP.

RECORD PERFORMANCE IN THE AIR

MEANS RECORD PERFORMANCE OF BEARINGS

SKF Bearings give a good account of themselves in the Formica control pulleys of the above Grumman JF-2 Coast Guard Amphibian. For this plane won the world's amphibian speed record at 191.76 miles per hour.

SKF easily carry heavy cable loads resulting from terrific air pressure on the rudder, ailerons and elevators. Having high radial capacity and minimum rim wobble, they meet Army and Navy standards, and their external surfaces are cadmium plated for protection against the elements. Their long record of good performance is conclusive proof they always make good on dependability.

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

3518

Official Aviation Records

List of world marks homologated by the Federation Aeronautique Internationale

●

● International supremacy in air records belongs to the United States by virtue of 39 records established by American pilots. The complete list of records, issued as of Oct. 1, by the F.A.I. follows. Records included subsequent to that date are supplied by AERO DIGEST.

WORLD RECORDS

Airline Distance: Maurice Rossi and Paul Cordos (France); Aug. 5-7, 1933; Floyd Bennett Field, N. Y., to Rayack, Syria; Bleriot 110 (550 h.p. Hispano-Suiza) . . . . 5657.387 mi.

Closed Course Distance: Lucien Bossoutrot and M. Rossi (France); March 23-26, 1932; Oran, Algeria; Bleriot 110 (500 h.p. Hispano-Suiza) . . . . 6587.441 mi.

Altitude: Capt. Albert W. Stevens and Capt. Orvil Anderson (U. S. A.) Nov. 11, 1935. Rapid City to White Lake, S. D. . . . . 72,395 ft.

Maximum Speed: Francesco Agello (Italy); Oct. 23, 1934; Desenzano; Macchi Castoldi 72 (3800 h.p. Fiat AS-6V) . . . . 440.681 m.p.h.

INTERNATIONAL CLASS RECORDS

Class C—Airplanes

Airline Distance: See World Records.

Closed Course Distance: See World Records.

Broken Line Distance: M. Rossi and P. Cordos (France); Aug. 5-7, 1933; Floyd Bennett Field, N. Y., to Le Bourget to Rhodes to Rayack, Syria; Bleriot 110 (550 h.p. Hispano-Suiza) . . . . 5658.400 mi.

Altitude: Commander Renato Donati (Italy); April 11, 1934; Rome, Italy; Caproni (600 h.p. Bristol Pegasus) . . . . 47,352 ft.

Maximum Speed: Howard Hughes (U. S. A.); Sept. 12, 1935; Santa Ana, Calif.; Hughes Racer (700 h.p. Pratt & Whitney Twin Wasp Jr.) 352.46 m.p.h.

SPEED OVER SPECIFIED DISTANCE (NO PAYLOAD)

100 Kilometers (62.137 mi.): Maurice Arnoux (France); Aug. 10, 1935; Etampes; Caudron (360 h.p. Renault-Bengali) . . . . . . 295.968 m.p.h.

1000 Kilometers (621.369 mi.): Raymond Delmotte (France); Aug. 24, 1935; Istres; Caudron C-460 (360 h.p. Renault-Bengali) . . . 279.948 m.p.h.

2000 Kilometers (1242.739 mi.): A. Biseo & G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . 236.742 m.p.h.

5000 Kilometers (3106.849 mi.): D. W. Tomlinson and J. S. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 710 h.p. Wright Cyclones) . . . . 169.031 m.p.h.

10.000 Kilometers (6213.698 mi.): J. LeBrix and M. Doret (France); June 7-10, 1931; Istres; Dewoitine (650 h.p. Hispano-Suiza) . . . 93.114 m.p.h.

RECORDS WITH PAYLOAD
500 KILOGRAMS

Speed (1000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 m.p.h.

Speed (2000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 236.742 m.p.h.

Speed (5000 Kilometers): D. W. Tomlinson and J. S. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 (710 h.p. Wright Cyclones) . 169.031 m.p.h.

Altitude: M. Signerin (France); Sept. 21, 1932; Villacoublay; Breguet 197 (620 h.p. Gnome & Rhone) 33,743.334 ft.

1000 KILOGRAMS

Speed (1000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 m.p.h.

Speed (2000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 236.742 m.p.h.

Speed (5000 Kilometers): D. W. Tomlinson and J. B. Bartles (U. S. A.); May 16-17, 1935; Floyd Bennett Field, N. Y.; twin-engined Douglas DC-1 (710 h.p. Wright Cyclones) . 169.031 m.p.h.

Altitude: M. Signerin (France); Sept. 21, 1932; Villacoublay; Breguet 197 (620 h.p. Gnome & Rhone) 29,461.853 ft.

2000 KILOGRAMS

Speed (1000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 242.564 m.p.h.

Speed (2000 Kilometers): A. Biseo and G. Castellani (Italy); Sept. 23, 1935; Monte Cavo, Monte Nerone, Ansedonia; tri-motored Savoia Marchetti S-79 (Alpha Romeo) . . . . . 236.742 m.p.h.

Altitude: Nicola diMauro and Giorgio Olivari (Italy); May 12, 1934; Montecelio, Rome; tri-motored Savoia Marchetti S-72 (Pegasus S-2) 27,683.643 ft.

5000 KILOGRAMS

Altitude: Lucien Coupet (France); June 16, 1934; Toussusle-Noble; four-engined Farman F.221 (Gnome & Rhone K14RSD) . . . . . . 21,814.239 ft.

10.000 KILOGRAMS

Altitude: C. D. Antonini (Italy); February 22, 1930; Cascina Malpensa; six-engined Caproni CA (1000 h.p. Isotta Fraschinis) . . . . 10,597 ft.

Greatest payload carried to an altitude of 2000 meters (6561.66 ft.): C. D. Antonini (Italy); Feb. 22, 1930; Cascina Malpensa; six-engined Caproni CA (1000 h.p. Isotta Fraschinis) . . . . 22,046.200 lbs.

LIGHT AIRPLANES—FIRST CATEGORY
(multi-place, empty weight less than 1234.576 lbs.)

Airline Distance: M. Laloulette and M. dePermangle (France); Jan. 11-12, 1931; Istres to Villa Cisneros; Farman 231 (95 h.p. Renault) . . 1809.429 mi.

Altitude: Renato Donati and (passenger) M. Lanciani (Italy); Dec. 30, 1932; Littorio Airport, Rome; Fiat ASI c.n.a. (CNAc) . . . . . . 30,453 ft.

Speed (100 Kilometers): M. Arnoux and Mme. Becker (Franc[illegible] 22) 8, 1935, Etampes; Caudron [illegible] ault) . . . . 281.942 m.p.h.

Speed (1000 Kilometers): M. Arnoux and Mme. Becker (France); July 7, 1935; Angiers; Caudron Rafale (140 h.p. Renault) . . . . 181.952 m.p.h

LIGHT AIRPLANES—SECOND CATEGORY
(one-place, empty weight less than 992.070 lbs.)

Airline Distance: Capt. Skarzinsk (Poland); May 7, 1933; St. Louis, Senegal to Maceio, Brazil; RWD 5bis (13 h.p. Gypsy Major) . . . 2225.747 m

Altitude: Furio Nicolet (Italy); Dec 24, 1933; Littorio Airport, Rome; E.T.A

(*Continued on following page*)

Continuous Development

How improvement in engine and aircraft performance has been anticipated by Hamilton Standard developments.

1925

Hamilton Standard adjustable-pitch metal propellers come into general use, supplanting fixed-pitch propellers.

1930

First entirely practicable controllable-pitch propeller designed and flown by Hamilton Standard.

1933

The Hamilton Standard controllable-pitch propeller adopted as an essential item of equipment on high performance aircraft. *Awarded the Collier Trophy as the greatest aeronautical achievement during 1933.*

1934

"Constant-speed" control for Hamilton Standard controllable-pitch propellers developed and successfully applied to multi-motored ships.

1935

Hamilton Standard constant-speed propeller adopted as standard air line equipment + + Is flown across the Pacific and back on the China Clipper + + Is used on flight establishing new world's landplane speed record.

1936

"Continuous development."

HAMILTON STANDARD PROPELLERS
East Hartford, Connecticut
DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

(*Continued from preceding page*)

(160 h.p. CNA) . . . 32,834.546 ft.

Speed (100 Kilometers): Arthur C. Chester (U. S. A.); Jan. 9, 1935; Miami, Fla.; Chester Special (Menasco C-4) . . . . 222.863 m.p.h.

Speed (1000 Kilometers): Raymond Delmotte (France); Dec. 26, 1933; Istres; Caudron 362 (150 h.p. Renault-Bengali) . . . . . . 206.834 m.p.h.

LIGHT AIRPLANES—THIRD CATEGORY

(multi-place, empty weight less than 617.288 lbs.)

Airline Distance: Sebastiano Bedendo and P. Nuvoli (Italy); Apr. 24, 1933; Cinisello-Milano to San Vito dei Normani-Brindisi; NS (75 h.p. Pobjoy) . . . . 550.954 mi.

Altitude: Giovanni Zapatta and (passenger) Ragus Francesco (Italy); Dec. 2, 1933; Montecelio, Rome; N-5 (75 h.p. Pobjoy) . . . . . . 22,805.049 ft.

Speed (100 Kilometers): Sebastiano Bedendo and Rinaldo Stenico (Italy); Feb. 17, 1935; Littoria Airport, Rome; N-5 (75 h.p. Pobjoy) . 138.303 m.p.h.

Speed (500 Kilometers): Sebastiano Bedendo and Rinaldo Stenico (Italy); Feb. 16, 1935; Littoria Airport, Rome; N-5 (75 h.p. Pobjoy) . 133.771 m.p.h.

Speed (1000 Kilometers): M. Bailey and M. Reginensi (France); Oct. 4, 1933; Villesauvage-La Marmogne; Farman 239 (75 h.p. Pobjoy) . . . . 121.639 m.p.h.

LIGHT AIRPLANES—FOURTH CATEGORY

(one-place, empty weight less than 440.920 lbs.)

Airline Distance: G. Fauvel (France); Sept. 10, 1929; St. Inglebert to Pau; Maubaussin-Peyret 10 (ABC Scorpion) . . . . 529.469 mi.

Altitude: G. Fauvel (France); Sept. 5, 1929; Le Bourget, Paris; Maubaussin-Peyret 10 (ABC Scorpion) . 17,037 ft.

Speed (100 Kilometers): S. J. Wittman (U. S. A.); Feb. 14, 1934; New Orleans, La.; Wittman Special (75 h.p. Pobjoy) . . . . . . 137.513 m.p.h.

Class C-2—Seaplanes

Airline Distance: Lieut. Comdr. Kneffler McGinnis and Lieut. J. K. Averill (U. S. A.); Oct. 14-15, 1935; Coco Solo, Canal Zone to San Francisco, Calif.; twin engined Consolidated flying boat XP3Y-1 (700 h.p. Pratt & Whitney Twin Wasp Jrs.) . . . . 3,300 mi.

Broken Line Distance: Lieut. Comdr. Kneffler McGinnis and Lieut. J. K. Averill (U. S. A.); Oct. 14-15, 1935; Coco Solo, Canal Zone to San Francisco, Calif.; twin-engined Consolidated flying boat XP3Y-1 (700 h.p. Pratt & Whitney Twin Wasp Jrs.) . . . . 3,450 mi.

Altitude: Lieut. A. Soucek (U. S. A.); June 4, 1929; Washington, D. C.; Wright Apache (450 h.p. Pratt & Whitney) . . . . 38,559.594 ft.

Maximum Speed: See World Records.

SPEED OVER SPECIFIED DISTANCE (NO PAYLOAD)

100 Kilometers: Guglielmo Cassinelli (Italy); Oct. 8, 1933; Falconara-Pesaro; Macchi C72 (2400 h.p. Fiat AS6) . . . . 391.072 m.p.h.

1000 Kilometers: Brig. Gen. F. M. Andrews (U. S. A.); Aug. 24, 1935; Willoughby Spit, Va.; twin-engined Martin B-12A seaplane (700 h.p. Pratt & Whitney Hornets) . . 168.034 m.p.h.

2000 Kilometers: Edwin C. Musick, Boris Sergievsky, Col. Charles A. Lindbergh (U. S. A.); Aug. 1, 1934; Stratford, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 157,319 m.p.h.

5000 Kilometers: Lieut. de vaisseau Paris and M. Gonord (France); June 4-5, 1931; Archachon; Latecoere 28-3 (600 h.p. Hispano-Suiza) . 86.723 m.p.h.

RECORDS WITH PAYLOAD
500 KILOGRAMS

Speed (1000 Kilometers): Brig. Gen. F. M. Andrews (U. S. A.); Aug. 24, 1935; Willoughby Spit, Va., twin-engined Martin B-12A seaplane (700 h.p. Pratt & Whitney Hornets) . . . . 168.034 m.p.h.

Speed (2000 Kilometers): Edwin C Musick, Boris Sergievsky, Col. Charles A. Lindbergh (U. S. A.); Aug. 1, 1934; Stratford, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 157.319 m.p.h.

Altitude: M. Bourdin (France); Jan. 26, 1934; Antibes; twin-engined Liore and Oliver (690 h.p. Hispano-Suizas) . . . . 31,272.871 ft.

1000 KILOGRAMS

Speed (1000 Kilometers): Brig. Gen. F. M. Andrews (U. S. A.); Aug. 24, 1935; Willoughby Spit, Va.; twin-engined Martin B-12A seaplane (700 h.p. Pratt & Whitney Hornets) . . . . 391.072 m.p.h.

Speed (2000 Kilometers): Edwin C. Musick, Boris Sergievsky, Col. Charles A. Lindbergh (U. S. A.); Aug. 1, 1934; Stratford, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 157.319 m.p.h.

Altitude: M. Bourdin (France); Dec. 26, 1933; Antibes; twin-engined Liore and Olivier (690 h.p. Hispano-Suizas) . . . . 29,081.277 ft.

2000 KILOGRAMS

Speed (1000 Kilometers): Edwin C. Musick, Boris Sergievsky, Col. Charles A. Lindbergh (U. S. A.); Aug. 1, 1934; Stratford, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 157.580 m.p.h.

Speed (2000 Kilometers): Edwin C. Musick, Boris Sergievsky, Col. Charles A. Lindbergh (U. S. A.); Aug. 1, 1934; Stratford, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 157.319 m.p.h.

Altitude: M. Bourdin (France); Jan. 3, 1934; Antibes; twin-engined Liore and Olivier (690 h.p. Hispano-Suizas) . . . . 24,629.190 ft.

5000 KILOGRAMS

Altitude: Boris Sergievsky and Raymond B. Quick (U. S. A.); May 17, 1934; Bridgeport, Conn.; four-engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 20,406.762 ft.

Greatest Payload carried to an altitude of 6,561.660 ft.: Boris Sergievsky (U. S. A.); Apr. 26, 1934; Bridgeport, Conn.; four engined Sikorsky S-42 (670 h.p. Pratt & Whitney Hornets) . . . . 16,608 lbs.

LIGHT SEAPLANES—FIRST CATEGORY

(multi-place, empty weight less than 1499.128 lbs.)

Airline Distance: M. Laulouette and M. Albert (France); May 13, 1931; Le Pecq to Caudebec-on-Caux; Farman 251 bis (95 h.p. Renault) . . . 76.155 mi.

Altitude: Furio Niclot and (passenger) Mariano Lanciani (Italy); Dec. 28, 1932; Littoria seaplane base, Rome; Fiat A.S.I.C.N.A. (CNA C-7) . . . . 24,153.470 ft.

Speed (100 Kilometers): M. Lallouette and M. Boulanger (France); Mar. 28, 1931; Draveil-Montereau; Farman 231 bis (95 h.p. Renault) . . . . 117.708 m.p.h.

LIGHT SEAPLANES—SECOND CATEGORY

(one-place, empty weight less than 1256.622 lbs.)

Airline Distance: Benjamin King (U. S. A.); June 25, 1935; Port Washington, N. Y., to Anacostia, D. C.; Aeronca C-3 seaplane (36 h.p. Aeronca E II 3A) . . . . 219.959 mi.

Altitude: Furio Niclot (Italy); Nov. 6, 1933; Littorio Airport, Rome; E.T.A. C.N.A. (160 h.p. C.N.A. C-7) . . . . 27,595.061 ft.

Speed (100 Kilometers): Alfred Grundke (Germany); June 13, 1930; Dessau; Junkers J 50-W seaplane (85 h.p. Armstrong Siddeley Genet) . . . . 102.544 m.p.h.

LIGHT SEAPLANES—THIRD CATEGORY

(multi-place, empty weight less than 771.610 lbs.)

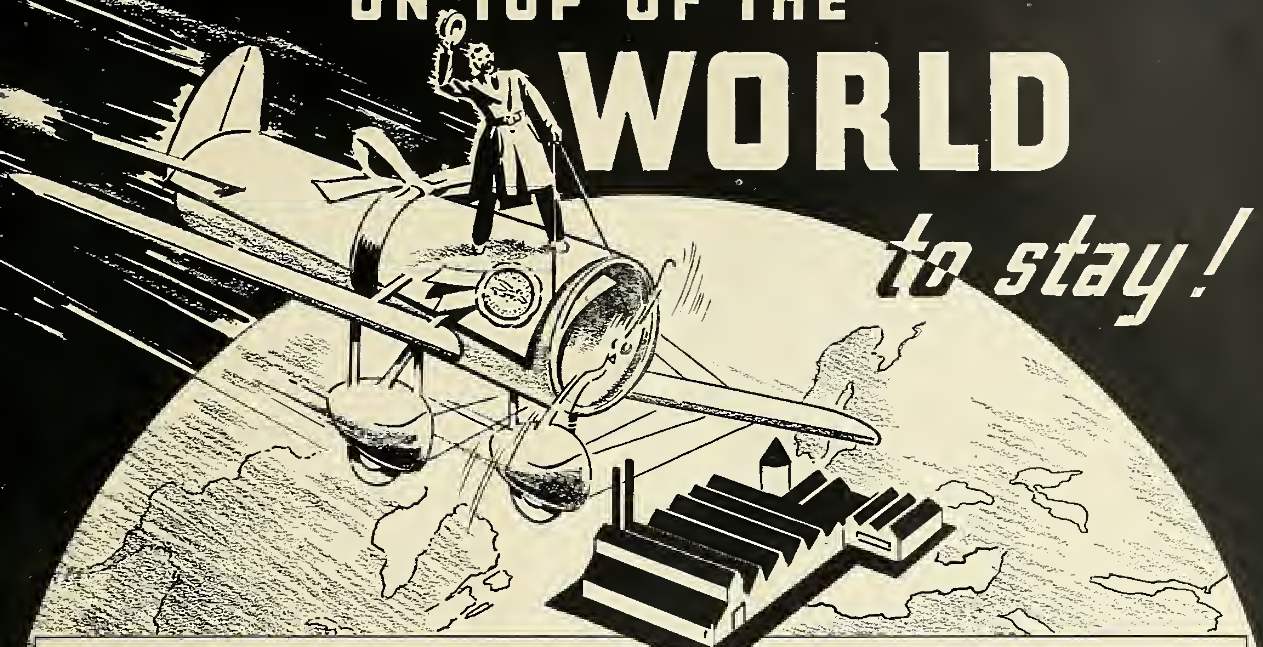
Airline Distance: Benjamin King (U. S. A.); June 16, 1935; North Beach, N. Y., to Whitney's Landing, Md.; Aeronca C-3 seaplane (36 h.p. Aeronca E II 3A) . . 185.398 mi.

Altitude: Jean de Viscaya and M. Forestier (France); June 11, 1931; Farman-Le Pecq; Farman F 231 (40 h.p. Salmson) . . . . . . 10,600.361 ft.

Speed (100 Kilometers): Jean de Viscaya and M. Chaudet (France); June 26, 1931; Le Pecq-Bonnieres-Le Roule; Farman 230 (40 h.p. Salmson) . . . . 89.191 m.p.h.

(*Continued on page* 102)

A CURTISS-WRIGHT DIPLOMA WILL PUT YOU ON TOP OF THE WORLD *to stay!*



Curtiss-Wright Technical Institute of Aeronautics, which specializes in the serious business of insuring YOUR success in aviation, knows the pitfalls you must avoid if you are to reach your goal.

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The Aeronautical Engineering Course, consisting of the 2000 hours of intense, practical instruction develops practical engineers and designers through sound technical training, backed by ample shop experience in actual construction work on modern aircraft. The course meets the latest Airworthiness Requirements of the Department of Commerce, Army and Navy and the industry. The instructors in charge are competent engineers of outstanding ability with long practical experience in aircraft research, design and construction; men who have actually worked for years as practical engineers in great organizations.

The Master Mechanics Course offers you complete, practical training for the high type mechanicians exacted by the industry. 1600 hours practical instruction, five days per week. Complete airplane and engine mechanics courses, metal fabrication, blue print reading, drafting, welding, and of special importance now—modern sheet metal construction. You receive actual hangar and line maintenance and actually repair modern airplanes in daily operation. Graduates are completely qualified to take charge of repairs or maintenance in all departments of aircraft work and do not have to serve an apprenticeship after graduation to obtain a license.

HEART OF THE INDUSTRY

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Of course, Los Angeles is world-famous as an all-year recreation center because of the ideal weather that prevails. Curtiss-Wright students obtain full use of this added benefit. Every sport is at hand, from Pacific Ocean bathing to mountain climbing in the highest peaks in America. Of further importance, living expenses in the Los Angeles territory are appreciably lower than elsewhere, a condition which is assisted by the elimination of heating and clothing problems. Students live in attractive bungalows just across the street from the school.

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INDEX TO THE MANUFACTURERS OF MACHINERY FOR AIRCRAFT PRODUCTION

The following pages contain a directory of the sources of supply of machines and special equipment used in the manufacture of aircraft and aircraft engines. The listings are as complete as could be made with the information available. The accompanying Index indicates the manufacturers listed. Data relating to the companies is given in the Directory Section (pages 44 to 45) where manufacturers are listed alphabetically.

PORTABLE UNITS
(Metal Working)

ADAPTER UNITS
Kingsbury Machine Tool Corp.

ANGLE BENDERS & ATTACHMENTS
Champion Blower and Forge Co.
Independent Pneumatic Tool Co.

BORES & REAMERS
Davis Boring Tool Company
Detroit Boring Bar Company
Kelly Reamer Company
Madison Manufacturing Company
Van Norman Machine Tool Co.

BRAKE BENDERS
Dries & Krump

BROACHES
American Broach Company
Colonial Broach Company
Ex-Cell-O Aircraft & Tool Corp.
LaSalle Machine Works

CHUCKS & COLLETS
Bicknell-Thomas Company
Consolidated Machine Tool Corp.
Cushman Chuck Company
Henry Disston & Sons, Inc.
Ex-Cell-O Aircraft & Tool Corp.
Errington Mech. Laboratories
Gardner Machine Company
Modern Tool Works
Monarch Machine Tool Co.
National Tool Company
New Britain-Gridley Machine Co.
Skinner Chuck Company
Thurston Company

CUTTING TOOLS
Bicknell-Thomas Company
Consolidated Machine Tool Corp.
Ex-Cell-O Aircraft & Tool Corp.
Gairing Tool Company
Geometric Tool Corporation
Haynes Stellite Company
Kutmore Tool Company
Modern Tool Works
Mummert-Dixon Company
H. K. Porter, Incorporated
Pratt & Whitney Company
J. T. Slocomb Company
Thurston Manufacturing Co.
W. W. & C. F. Tucker, Inc.
Wadell Engineering Company

DIES & DIE HEADS
John Bath & Company
S. W. Card Mfg. Company
Champion Blower & Forge Co.
Consolidated Machine Tool Corp.
Eastern Machine Screw Corp.
General Electric Company
Geometric Tool Company
Jones & Lamson Machine Co.
Modern Tool Works
Muchey Machine & Tool Co.
Pratt & Whitney Company
Wrought Washer Mfg. Co.

DRILLS
Cleveland Pneumatic Tool Co.
Dumore Company
Independent Pneumatic Tool Co.
Pratt & Whitney Company
N. A. Strand & Company
Union Twist Drill Company

DRILL FIXTURES
Cleveland Universal Jig Co.
Hoefer Mfg. Company
Siewek Tool Company

FACING HEADS
Mummert-Dixon Company

FILING MACHINES
Black Diamond Saw & Machine Wks., Inc.
N. A. Strand & Company

FLEXIBLE SHAFTS
Dumore Company
Pratt & Whitney Co. (Kellerflex)
N. A. Strand & Company

GEAR CUTTERS
Fellows Gear Shaper Company

GRINDERS
Abrasive Machine Company
Biax Jarvis Manufacturing Co.
Cedar Rapids Eng. Co. of Del.
Chicago Pneumatic Tool Co.
Cleveland Pneumatic Tool Co.
Dumore Company
R. G. Haskins Company
Independent Pneumatic Tool Co.
Muchey Machine & Tool Co.
Mummert-Dixon Company
Thomas Prosser & Son
N. A. Strand & Company
Van Norman Machine Tool Co.
Walker Turner Company, Inc.

WHEELS
Blanchard Machine Company

HOBBERS
Baker-Colman Company
Michigan Tool Company

KEYSEATERS & CUTTERS
Davis Keyseater Company

PAINT SPRAY EQUIPMENT
Alexander Milburn Company

POLISHERS
Cleveland Pneumatic Tool Co.
Dumore Company
R. G. Haskins Company
N. A. Strand & Company

PORTABLE ELECTRIC TOOLS
Black & Decker Mfg. Co.
Dumore Company
Independent Pneumatic Tool Co.
Skilsaw, Incorporated
Standard Electric Tool Company
N. A. Strand & Company
Van Dorn Electric Tool Co.

PROPELLER PROTRACTORS, ADAPTERS
Taft Peirce Manufacturing Co.

PUNCHES
Pratt & Whitney Company
W. A. Whitney Mfg. Co.

RIVETERS
Cleveland Pneumatic Tool Co.
Hannifin Manufacturing Co.

ROTARY FILES
R. G. Haskins Company

SCREW PLATES
S. W. Card Manufacturing Co.
Pratt & Whitney Company

SHEARS
Henry Pels & Company

STUD DRIVERS, SETTERS, PULLERS
Apex Broach Company
Black Diamond Saw & Machine Co., Inc.
Consolidated Machine Tool Corp.
R. G. Haskins Company
Independent Pneumatic Tool Co.
Modern Tool Works
N. A. Strand & Company
Titan Tool Company
Van Norman Machine Tool Co.

TAPS & TAPPING EQUIPMENT
John Bath & Company
Bicknell-Thomas Company
S. W. Card Manufacturing Co.
Consolidated Machine Tool Corp.
Detroit Tap & Tool Company
Geometric Tool Company
Hanson-Whitney Machine Co.
R. S. Haskins Company
Modern Tool Works
Pratt & Whitney Company
Winter Brothers

THREAD MILLERS
Hanson-Whitney Machine Co.

TOOLS
Baker-Colman Company
Baldwin, Tuthill & Bolton
Cleveland Twist Drill Company
Henry Disston & Sons, Inc.
Ex-Cell-O Aircraft Tool Co.
Gallmeyer & Livingston Company
Hjorth Lathe & Tool Company
McCrosky Tool Corporation
Millersburg Reamer & Tool Co.
National Twist Drill Company
W. H. Nicholson & Company
Nielsen, Inc.
Pratt & Whitney Company
Sebastian Lathe Company
Standard Tool & Mfg. Co.
Stevens Walden, Incorporated
N. A. Strand & Company
Taft Peirce Manufacturing Co.
Union Twist Drill Company
Western Tool & Mfg. Co.
Wetmore Reamer Company

Carboloy

Ex-Cell-O Aircraft & Tool Corp.
General Electric Company

Circular Forming

Continental Tool Works
Michigan Tool Company

High Speed

Continental Tool Works
Gorham Tool Company
U. S. Tool Company

Spotfacing

Gairing Tool Company
Mummert-Dixon Company

Tungsten Carbide

Firth-Sterling Company
Gairing Tool Company
Kearney & Trecker Corporation
Thomas Prosser & Sons

VALVE FACING MACHINES
Cedar Rapids Eng. Co. of Del.
Van Norman Machine Tool Co.

VALVE RESEATING TOOLS
Cedar Rapids Eng. Co. of Del.

VALVE SEAT GRINDING TOOLS
Albertson & Company
Cedar Rapids Eng. Co. of Del.
Van Norman Machine Tool Co.

VALVE SEAT TOOLS
Cedar Rapids Eng. Co. of Del.
Van Norman Machine Tool Co.

WASHERS
Wrought Washer Mfg. Co.

WELDING APPARATUS
Bastian Blessing Company
General Electric Company
Harnischfeger Corporation
Alexander Milburn Company
Thomson-Gibb Elec. Welding Co.
Torchweld Equipment Co.
Westinghouse Elec. & Mfg. Co.
Wilson Welder & Metals Co., Inc.

(Wood Working)

PATTERN SHOP ACCESSORIES
Oliver Machine Company

ROTARY ATTACHMENTS
Reed-Prentice Corp.

ROUTERS
R. L. Carter Company

SANDERS
Cleveland Pneumatic Tool Co.
R. G. Haskins Company
Skilsaw, Incorporated

SAWING MACHINES
Reed-Prentice Corp.
Skilsaw, Incorporated

SHAPERS
Crescent Machine Company

STATIONARY UNITS
(Metal Working)

BEADING MACHINES
Peck, Stow & Wilcox Company
Niagara Machine & Tool Works

BORING MACHINES
Automatic Machine Company
Cedar Rapids Eng. Co. of Del.

Diamond Machine Company
Ex-Cell-O Aircraft & Tool Corp.
R. Y. Ferner Company
Moline Tool Company
Pratt & Whitney Company

BRAKE BENDERS
Champion Blower & Forge Co.
Dries & Krump

DEMAGNETIZERS
Blanchard Machine Co.

DIE & DIE SINKING MACHINES
Bignall & Keller Machine Works
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Oliver Instrument Co.
Pratt & Whitney Company
Reed-Prentice Corporation
Thurston Mfg. Company
Waterbury Farrel Foundry & Mach. Co.

DRILLS
C. G. Allen
American Tool Works Co.
M. E. Avery Company
Avey Drilling Machine Co.
Barnes Drill Company
Buffalo Forge Company
Canedy-Otto Mfg. Company
Carlton Machine Tool Co.
Champion Blower & Forge Co.
Cincinnati Bickford Tool Co.
Cincinnati Shaper Co.
R. Y. Ferner Company
Foot-Burt Company
Fosdick Machine Tool Co.
Grand Mfg. & Mach. Co.
Kingsbury Machine Tool Corp.
Langelier Mfg. Company
Leland-Gifford Company
Minister Mach. Company
Morris Machine Tool Co.
Motch-Merryweather Machine Co.
National Machine Tool Co.
Pratt & Whitney Company
Providence Eng. Works, Inc.
Reliance Machine Sales Co.
J. T. Ryerson & Son, Inc.
Standard Electric Tool Co.
U. S. Machinery Company

FILING MACHINES
Cochrane-Bly Company

FORMERS
Engineering & Research Corp.
Peck, Stow & Wilcox Co.

GEAR CUTTERS
Bilgram Mach. Works
Fellows Gear Shaper Co.
Newark Gear Cutting Mach. Co.
Thurston Mfg. Company

GEAR GENERATORS
Fellows Gear Shaper Co.
Gleason Works
Lees-Bradner Company

GEAR LAPPERS
Fellows Gear Shaper Co.
National Broach & Mach. Co.

GEAR SHAPERS
Fellows Gear Shaper Co.

GRINDERS
Abrasive Machine Company
Biax Jarvis Mfg. Company
Bignall & Keller Mach. Works
Blanchard Machine Co.
J. G. Blount Company
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Cedar Rapids Eng. Co. of Del.
Champion Blower & Forge Co.
Cincinnati Electric Tool Co.
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Diamond Machine Company
Ex-Cell-O Aircraft & Tool Corp.
Gallmeyer & Livingston Co.
Gardner Machine Company
Grand Rapids Grinder Mach. Co.
Grand Rapids Machine Co.
Heald Machine Company
Landis Tool Company
Micro Machine Company
Mummert-Dixon Company
Norton Company
Oliver Instrument Company
Oesterlein Machine Company
Pratt & Whitney Company
Rivett, Lathes & Grinder, Inc.
Geo. Scherr Company
Skilsaw, Incorporated
Standard Electric Tool Co.
Stanley Works
Stevens Walden, Incorporated
Taylor & Fenn Company
U. S. Electrical Tool Co.
Valley Electric Company
Van Norman Machine Tool Co.

HOBBERS
Brown & Sharpe Mfg. Co.
Gould & Eberhardt
Lees-Bradner Company
Michigan Tool Company
George Scherr Company
Union Twist Drill Co.

INSPECTION MEASURING MACHINES
Fellows Gear Shaper Co.
Jones & Lamson Machine Co.
Lees-Bradner Company
George Scherr Company

LAPPING MACHINES
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Moline Tool Company

LATHES
American Tool Works Co.
Atlas Press Company
Automatic Machine Company
J. G. Blount Company
Brown Machinery Company
Brown & Sharpe Mfg. Co.
Cone Automatic Machine Co.
Colcord-Wright Machinery Co.
Elliott & Stephens
Fay Automatic Machine Tool Co.
Gardner Machine Company
R. K. LeBlond Machine Tool Co.
Monarch Machine Tool Co.
Kent Owens Machine Company
Pratt & Whitney Company
George Scherr Company
Sebastin Lathe Company
Seneca Falls Mfg. Company
Seneca Falls Machine Co.
Stark Tool Company
Warner & Swasey Company
Waterbury Farrel Foundry & Mach. Co.
Wickes Bros.

Automatic
Cone Automatic Machine Co.
Jones & Lamson Mach. Co.
R. K. LeBlond Mach. Tool Co.
Lodge & Shipley Mach. Tool Co.
Monarch Machine Tool Co.
Potter & Johnson Machine Co.
Seneca Falls Machine Co.
Sunstrand Machine Tool Co.
Waterbury Farrel Foundry & Mach. Co.

Engine
Champion Blower & Forge Co.
Fay Automatic Machine Tool Co.
Flather Co.
Greaves-Klusman Tool Co.
Hendey Machine Co.
Ideal Machinery Co.
Lehman Machine Co.
Monarch Machine Tool Co.
South Bend Lathe Works
Springfield Machine Co.

Heavy Duty
Boye & Emmes Machine Tool Co.
Gisholt Machine Co.
Reed-Prentice Corp.
Warner & Swasey Company

Manufacturing
Adams Company
Bullard Company
R. K. LeBlond Machine Tool Co.
Lodge & Shipley Mach. Tool Co.
Monarch Machine Tool Co.

Precision
Gisholt Machine Co.
Hardinge Bros., Inc.
Hjorth Lathe & Tool Co.
Lodge & Shipley Mach. Tool Co.
Reed-Prentice Corp.
Rivett Lathe & Grinder, Inc.

Screw Cutting
Champion Blower & Forge Co.
Rivett, Lathe & Grinder, Inc.

Turret
Acme Machine Tool Co.
Bardons & Oliver
Bullard Company
Foster Machine Co.
Gisholt Machine Co.
Jones & Lamson Machine Co.
Universal Boring Machine Co.
Warner & Swasey Company

MILLING MACHINES
B. C. Ames Company
Automatic Machine Co.
Brown & Sharpe Mfg. Co.
Burke Machine Tool Co.
Cincinnati Milling Machine & Cincinnati Grinders, Inc.
Cincinnati Shaper Co.
Cochrane-Bly Co.
Consolidated Machine Tool Corp. of America
Continental Tool Works
R. Y. Ferner Co.
George Gorton Machine Co.
Gould & Eberhardt
Hall Planetary Co.
Hanson-Whitney Machine Co.
Hardinge Bros., Inc.
Harron, Rickard & McCone Co.
Hendey Machine Co.
Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Kearney & Trecker Corp.
W. B. Knight Machine Co.
Lucas Machine Tool Co.
Manning, Maxwell & Moore
Oesterlein Machine Co.
Kent Owens Machine Co.
Pratt & Whitney Company
Reed-Prentice Corp.
Reisinger Machine Tool Corp.
Sunstrand Machine Tool Co.
Taylor & Fenn Company
Thurston Mfg. Company
Union Twist Drill Co.
U. S. Electrical Tool Co.
U. S. Standard Mfg. Co.
Van Norman Machine Tool Co.
Waterbury Farrel Foundry & Machine Co.

MOLDERS
J. A. Fay & Egan Co.

NIBBLERS
G. A. Gray Co.
Hall & Brown Machine Co.
W. J. Savage Co., Inc.

PLANERS
Automatic Machine Co.

POLISHERS AND BUFFERS
Champion Blower & Forge Co.
Hisey-Wolf Machine Co.
Rowbottom Machine Co.
Standard Electric Tool Co.

PRESSES
Adriance Machine Works, Inc.
Atlas Press Company
E. W. Bliss Company
C. F. Elmes Engineering Works
Ferracute Machine Co.
Fox Machine Co.
Hall & Brown Machine Co.
LaSalle Machine Works
Geo. E. Moore
Peck, Stow & Wilcox Co.
Perkins Machine Co.
Quickwork Company
F. J. Swaine Company
Taylor & Fenn Company
Titan Tool Company
V & O Press Company
Waterbury Farrel Foundry & Machine Co.
Watson-Stillman Co.
Weaver Mfg. Company
Wellman, Saver & Morgan Co.

Arbor
Atlas Press Company
Champion Blower & Forge Co.
Greenerd Arbor Presses
Stedfast & Roulston, Inc.

Drill
C. G. Allen
American Tool Works Co
Atlas Press Company
M. E. Avery Company
Barnes Drill Company
W. F. & John Barnes Co.
Bausch Machine & Tool Co.
Blackman Hill Co.
Burke Machine Tool Co.
Canedy-Otto Mfg. Co.
Excelsior Tool & Machine Co.
Foot-Burt Company
Sidney Machine Co.
J. E. Snyder & Son
Walker Turner Co., Inc.
Henry Wright Mfg. Co.

PROPELLER PROFILERS
Engineering & Research Corp.

POWER HAMMERS
Champion Blower & Forge Co.
Pettingell Machine Co.
Quickwork Company
Yoder Company

PUNCHES & SHEARERS
Buffalo Forge Co.
Champion Blower & Forge Co.
Engineering & Research Corp.
Gammons-Holman Co.
John J. Normoyle Co.
Peck, Stow & Wilcox Co.
Quickwork Co.
W. A. Whitney Mfg. Co.
Wiedemann Machine Co.

RIVETERS
Cleveland Pneumatic Tool Co.
Hannifin Mfg. Co.
High Speed Hammer Co., Inc.
Penn Rivet Corp.

SAWS
Champion Blower & Forge Co.
Cochrane-Bly Co.
DeWalt Products Co.
Henry Disston & Sons
Etna Machine Co.
J. A. Fay & Egan Co.
Peerless Machine Co.
Racine Tool & Machine Co.
W. Robertson Machine & Foundry Co.
Wickes Bros.

SCREW MACHINES
Acme Machine Tool Co.
Foster Machine Co.
Hardinge Bros., Inc.
National Acme Co.
New Britain-Gridley Machine Co.
Potter & Johnson Machine Co.
Warner & Swasey Company

SHAPERS
Advance Machine Co.
Cincinnati Shaper Co.

Cochrane-Bly Co.
Gould & Eberhardt
Potter & Johnson Machine Co.
Pratt & Whitney Co.
Smith & Mills Co.
Walker Turner Co., Inc.

SHEARS
Brown Machinery Co.
Buffalo Forge Co.
Champion Blower & Forge Co.
Niagara Machine & Tool Works
Peck, Stow & Wilcox Co.

STRAIGHTENERS
E. Corey & Co.

TAPPING MACHINES
Baker Bros.
Fosdick Machine Tool Co.
W. Gateman Mfg. Co.
Kingsbury Machine Tool Corp.
Rickers-Shafer Co.
Simmons Mfg. Co.

THREAD & THREAD CHASERS
Eastern Machine Screw Co.
Geometric Tool Co.
Landis Tool Co.
Rickers-Shafer Co.

TOOLS
Blanchard Machine Company
Brown-McLaren Mfg. Co.
Champion Blower & Forge Co.
Continental Tool Works
Oilgear Company
Scully-Jones

TUBE CUTTERS
DeWalt Products Company

CYLINDER BORING MACHINERY
Cedar Rapids Eng. Co. of Del.

TOOL GRINDERS
Gisholt Machine Co.

TURRET MACHINES
Cleveland Automatic Machine Co.

UNISHEARS
The Stanley Works
U. S. Electrical Tool Co.

VALVE REFACERS
Hunter Havens

WELDERS
Thomson-Gibb Elec. Welding Co.

(Wood Working)

BAND FILERS
Buss Machine Co.
Champion Blower & Forge Co.
Continental Mach. Spec., Inc.
Crescent Machine Co.
Henry Disston & Sons, Inc.
Horn Device Mfg. Co.
Racine Tool & Mach. Co.
Walker Turner Company, Inc.
J. D. Wallace & Co.

BORERS
Crescent Machine Co.
Oliver Machinery Co.

GRINDERS
Crescent Machine Co.
C. O. Porter Machinery Co.

JOINTERS
American Woodworking Mach. Co.
Champion Blower & Forge Co.
Crescent Machine Co.
Heston & Anderson
Hutchinson Manufacturing Co.
Oliver Machinery Co.
Kent Owens Machine Co.
C. O. Porter Machinery Co.
J. D. Wallace & Co.
Yates-American Mach. Co.

LATHES
Atlas Press Company
Crescent Machine Co.
Greenfield Tap & Die Corp.
Oliver Machinery Co.
C. O. Porter Machinery Co.
Walker Turner Co., Inc.

MORTISERS
Oliver Machinery Co.

PATTERN MAKERS' MACHINERY
Mummert-Dixon Co.

PLANERS
Buss Machine Works
Champion Blower & Forge Co.
Cleveland Planer Co.
Crescent Machine Co.
G. A. Gray Co.
Kent Owens Machine Co.
Oliver Machinery Co.
C. O. Porter Machinery Co.

ROUTERS
Oliver Machinery Co.
Onsurd Machine Co.
C. O. Porter Machinery Co.

SANDERS
Hall & Brown Machine Co.
C. O. Porter Machinery Co.
Porter-Cable Mach. Co.
H. B. Smith Machine Co.
Stanley Works
Sterling Products Co.

SAWS
Beach Manufacturing Co.
Beebe Bros.
Henry Disston & Sons, Inc.
Earl Gear & Machine Co.
Hall & Brown Machine Co.
Heston & Anderson
Hutchinson Manufacturing Co.
Independent Pneumatic Tool Co.
W. B. Mershon & Company
Oliver Machinery Company
C. O. Porter Machinery Company
Sumner Iron Works
Wagner Electric Corp.
Walker Turner Company, Inc.
J. D. Wallace & Company
Baxter D. Whitney & Son, Inc.
Yates-American Machine Co.

SHAPERS
Buss Machine Works
New Advance Machine Co.
Oliver Machinery Co.
C. O. Porter Machinery Co.
Baxter D. Whitney & Son, Inc.

SURFACERS
Baxter D. Whitney & Son, Inc.

TAPS
Greenfield Tap & Die Corp.

TRIMMERS
Oliver Machinery Co.

MISCELLANEOUS UNITS

AIRBRUSHES
DeVilbiss Company
Eclipse Air Brush Company
Passche Airbrush Company

ANODIC TANKS
Taylor Instrument Company

BALANCING MACHINES
Gisholt Machine Company
Taft Peirce Manufacturing Co.

BATTERY CHARGERS
General Electric Company

BLOWERS
Champion Blower & Forge Co.
Pangborn Corporation
Standard Electric Tool Company

BLOW PIPES, TIPS & GUNS
American Gas Furnace Company
Cleveland Pneumatic Tool Co.

BLUEPRINTING MACHINERY
Wickes Brothers

BOX NAILING MACHINES
Parker Machine Works

BURNERS
Bellevue Industrial Furnace Co.

CADMIUM PLATING EQUIPMENT
Niagara Machine & Tool Works

CLOTH CUTTING MACHINES
Eastman Machine Company

CONTROLLERS
Baldwin-Southwark Corp.
General Electric Company
Leeds & Northrup Company
Taylor Instrument Company

CORE WIRE MACHINES
Worthington Pump & Mch. Corp.

CRANES & HOISTS
Canton Foundry & Mch. Company
Harnischfeger Corporation
Peerless Machine Company

COATING-PAINTING MACHINES
C. E. Francis Company
Passche Airbrush Company

CEMENT-GRINDING COMPOUNDS
Gardner Machine Company

DRYERS
Gehnrich Corporation

DUST COLLECTORS
Pangborn Corporation

EXHAUSTERS
Champion Blower & Forge Co.
DeVilbiss Company
Pangborn Corporation
Standard Electric Tool Company

FILTERS
Fostoria Pressed Steel Corp.

FIRE BRICK
Bellevue Industrial Furnace Co.

FORGES
American Gas Furnace Company
Champion Blower & Forge Co.
J. H. Knapp Company, Inc.

FURNACES & OVENS
American Gas Furnace Company
Bellevue Industrial Furnace Co.
Buffalo Forge Company
Electric Furnace Company
Foundry Equipment Company
Gehnrich Corporation
Hevi-Duty Electric Company
Hoskins Manufacturing Co.
C. I. Hayes
J. H. Knapp Company, Inc.
Leeds & Northrup Company
Strong, Carlisle & Hammond
Surface Combustion Company
Harold E. Trent Company
Young Brothers

SAND BLASTING EQUIPMENT
Pangborn Corporation

GAUGES, TESTING & MEASURING APPARATUS
John Bath & Co.
Hjorth Lathe & Tool Company
Pratt & Whitney Company
(Keller Div.)
George Scherr Company

GLUE POTS, MIXERS, SPREADERS
C. E. Francis Company
General Electric Company
Oliver Machinery Company

GLUE PRESSES
C. E. Francis Company

HEATERS
American Gas Furnace Company
Champion Blower & Forge Co.
Gehnrich Corporation
General Electric Company

HYDRAULIC JACKS, PRESSES
American Chain Company

IMPREGNATORS, ENAMELERS, FILTERS
L. J. Barrett Company

INSTRUMENTS
Leeds & Northrup Company

MOTORS & TURBINES
Atlas Press Company
Dumore Company
General Electric Company
Harnischfeger Corporation
Oliver Machinery Company

MOUNTINGS
R. G. Haskins Company

PURIFIERS
Alexander Milburn Company

RECLAIMERS
Sharples Specialty Company

SEWING MACHINES
Singer Sewing Machine Company
Union Special Machine Company

SPRAY PAINTING BOOTHS & OUTFITS
DeVilbiss Company
New England Blower Company
Passche Airbrush Company

STANDS
American Chain Company
Cedar Rapids Eng. Co. of Del.
Oliver Machinery Company
Standard Electric Tool Co.
Stanley Works

TESTING MACHINES
Baldwin-Southwark Corp.
Tinius Olsen Testing Mch. Co.
Scintilla Magneto Company
Toledo Scale Company
Wilson Mech. Instrument Co.

TUMBLING BARRELS
Globe Tapping Machine Company

VENEER IRONING PRESSES
C. E. Francis Company

VISES
Champion Blower & Forge Co.

WASH TANKS
Southern Iron & Equip. Co.

WIRE TIEING MACHINES
Parker Machine Works

X-RAY
General Electric Company

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"*Primary Flight Group*"

Because Pioneer builds every instrument needed for complete flight control, and builds it superlatively well, Pioneer remains foremost in the esteem of Airmen. Pioneer Compasses, Tachometers, Turn and Bank Indicators, Climb Indicators, Altimeters, Airspeed Indicators and other Pioneer Aerial Navigation Instruments are relied upon by the Army, Navy, Coast Guard, and Marine Corps and by commercial airlines and private owners the World over.

IONEER INSTRUMENT CO., INC.

4 LEXINGTON AVE., BKLYN, N.Y. • SUBSIDIARY OF BENDIX AVIATION CORP.

Manufacturers of Machinery for Aircraft Production

A

ABRASIVE MACHINE CO., Providence, R. I.
Products: Grinding machines.

ACME DIAMOND TOOL CO., 170 Broadway, New York, N. Y.
Products: Diamond pointed tools (wheels; dressers).

THE ACME MACHINE TOOL CO., Cincinnati, O.
Products: Lathes (turret). Screw machines.

THE ADAMS COMPANY, 1900 Bridge St., Dubuque, Iowa
Products: Production lathes.

ADRIANCE MACHINE WORKS, INC., Richards St., Brooklyn, N. Y.
Products: Presses (foot; hand).

ADVANCE MACHINE CO., Minneapolis, Minn.
Products: 2-spindle shapers.

ALBERTSON & CO., Sioux City, Iowa
Products: Valve grinding tools.
Personnel: H. A. Jacobson, advertising manager.

CHARLES G. ALLEN, Barre, Mass.
Products: Drills (sensitive high-speed press; spindle; bench; overhang). Drill presses.

AMERICAN BROACH CO., Ann Arbor, Mich.
Products: Broaches.

AMERICAN CHAIN COMPANY York, Pennsylvania (Manley Mfg. Division)
Products: Hydraulic equipment (jacks; presses; motor stands).
Branch offices: New York, N. Y.; Boston, Mass.; Chicago, Ill.; York, Pa.; San Francisco, Calif.; Pittsburgh, Pa.; Detroit, Mich.
Personnel: O. R. McDonald, sales manager.

AMERICAN GAS FURNACE CO., Elizabeth, N. J.
Products: Furnaces (oven; melting; carburizing). Gas forges. Burners. Blowpipes and tips. Burners. Heating machines. Continuous heat treating machines.

THE AMERICAN TOOL WORKS CO., Cincinnati, Ohio
Products: Drilling machines (radial press; high-speed sensitive radial; triple purpose plain radial). Drill presses. Lathes.

AMERICAN SAW & MFG. CO., Springfield, Mass.
Products: Hack saws. Accessories.

AMERICAN WOODWORKING MACHINE CO., Rochester, N. Y.
Products: Jointers.

B. C. AMES CO., Waltham, Mass.
Products: Milling machines (bench).

APEX BROACH CO., Dayton, Ohio
Products: Stud drivers and setters.

ATLAS PRESS COMPANY, Kalamazoo, Mich.
Products: Lathes (metal; wood; attachments). Drill presses and attachments. Presses (hydraulic; mechanical). Motors. Arbor presses.
Branch offices: 35 E. Wacker Drive, Chicago, Ill.
Personnel: G. C. Nancarrow, sales manager.

THE AUTOMATIC MACHINE CO., Bridgeport, Conn.
Products: Diamond tool boring machines. Automatic threading chasing lathes. Shaping planers. Hob thread milling machines.
Personnel: W. R. Webster, president; J. Coulter, vice-president; H. G. Emt, chief engineer; H. C. Irving, sales manager; T. R. Coulter, purchasing agent.

M. E. AVERY CO., Watertown, N. Y.
Products: Drilling machines (one-to-three-spindle; high-speed). Drill presses. Mill band cut-off machines. Attachments.

AVEY DRILLING MACHINE CO., Cincinnati, O.
Products: Drills (1 to 6 spindle).

B

BAKER BROS., INC., Toledo, Ohio
Products: Tapping machines. Accessories.

BAKER-COLMAN CO., Rockford, Ill.
Products: Hobbers (thread milling; gear). Reamers.

BALDWIN-SOUTHWARK CORP., Philadelphia, Pennsylvania
Products: Recording and control equipment (*Huggenberger* tensometers; *DeForest* scratch recording strain gauges; electric telemeters; *Southwark-Emery* testing machines).
Personnel: G. F. Houston, president; W. H. Harman, vice-president and general manager.

BALDWIN TUTHILL & BOLTON, Grand Rapids, Mich.
Products: Knife grinders.

BARDONS & OLIVER, 1133 W. 9th, Cleveland, Ohio
Products: Turret lathes.

W. F. & JOHNS BARNES CO., Rockford, Ill.
Products: Drill presses.

BARNES DRILL COMPANY, 830 Chestnut St., Rockford, Ill.
Products: Drilling machines (round and square column; sliding head; swing table; one-to-six-spindle; box column). Drill presses.

THE LEON J. BARRETT CO., Worcester, Mass.
Products: Centrifugal machines (impregnators; enamelers; filters).
Personnel: N. F. Holter, chief engineer; W. A. Hyde, director of research; C. F. Moss, enamel department; H. H. Wright, sales manager.

THE BASTIAN BLESSING CO., 240 E. Ontario St., Chicago, Ill.
Products: *Rego* welding and cutting equipment.
Personnel: L. G. Blessing, president; E. L. Mills, vice-president and sales manager.

JOHN BATH & COMPANY, Worcester, Mass.
Products: High speed ground thread taps. Thread gauges. *Bath* internal micrometers. Roll threading dies.
Personnel: J. C. Bath, president; S. W. Bath, vice-president; E. A. Walker, chief engineer; O. F. Stromberg, superintendent.

BAUSCH MACHINE & TOOL CO., 156 Wasen, Springfield, Mass.
Products: Multi-spindle drill presses.

BEACH MANUFACTURING CO., Montrose, Pa.
Products: Rip saws.

BEEBE BROS., Seattle, Wash.
Products: Jig saws.

BELLEVUE INDUSTRIAL FURNACE CO., 2971 Bellevue, Detroit, Mich.
Products: Furnaces (gas fired tool room; gas fired pot; brass and aluminum melting and crucible heating). Fire brick. Oil and gas burners. Spencer turbo-compressors. Oil pumps. Pyrometers for brass and aluminum.

BIAX JARVIS MFG. CO., Portland, Conn.
Products: Grinders (flexible shaft; bench).

BICKNELL-THOMAS CO., Greenfield, Mass.
Products: Cutting tools (counterbores; countersinks; core drills; spotfacers). Tapping machines. Chucks.
Personnel: George A. Midwood, Jr., treasurer.

BIGNALL & KELLER MACHINE WORKS, Edwardsville, Ill.
Products: Grinding machines.

BILGRIM MACHINE WORKS, Philadelphia, Pa.
Products: Gear cutting machines.

THE BLACK & DECKER MANUFACTURING CO. and VAN DORN ELECTRIC TOOL CO., Towson, Maryland
Products: Portable electric tools (drill, torsimeters, sanders, valve seat grinders, valve refacers). Russell-Wilford variable speed controls. Accessories.
Factories: Towson, Md.; Toronto, Ont., Canada; Slough, Bucks, England; Sydney, Australia.
Branch offices: 319 Spring St., N.W., Atlanta, Ga.; 48 Brookline Ave., Boston, Mass.; 31 Barker St., Buffalo, N. Y.; 2009 S. Michigan Ave., Chicago, Ill.; 2028 E. 22 St., Cleveland, O.; 213 Henry St., Dallas, Tex.; 708 18 St., Denver, Colo.; 2818 E. Grand Blvd., Detroit, Mich.; 304 E. 17 St., Kansas City, Mo.; 1421 S. Flower St., Los Angeles, Calif.; 1012 Marquette Ave., Minneapolis, Minn.; 461 Eighth Ave., New York, N. Y.; 545 E. 10 St., Oakland, Calif.; 710 N. 16 St., Philadelphia, Pa.; 2822 Locust St., St. Louis, Mo.
Personnel: S. Duncan Black, president; Alonzo G. Decker, vice-president and general manager; R. D. Black, sales manager; F. H. Schell, sales.

BLACK DIAMOND SAW & MACHINE WORKS, INC., 43 North Ave., Natick, Mass.
Products: Filing machines. Setting machines.

BLACKMAN HILL CO., St. Louis, Mo.
Products: Drill presses.

THE BLANCHARD MACHINE CO., 64 State St., Cambridge, Mass.
Products: Vertical surface grinders. Grinding wheels. Demagnetizers. Work washing attachments. Reaming machines.
Personnel: Henry K. Spencer, manager.

E. W. BLISS COMPANY, 53rd & 2nd Ave., Brooklyn, N. Y.
Products: Inclinable presses (consolidated power; punch; geared punch).

J. G. BLOUNT CO., Everett, Mass.
Products: Grinders. Motor driven speed lathes. Attachments.

THE BOYE & EMMES MACHINE TOOL CO., Cincinnati, Ohio
Products: Lathes (heavy duty).

BROWN-McLAREN MFG. CO., Detroit, Mich.
Products: Reamers.

(*Continued on following pages*)

IT'S READY!

THE READING AERO BATTERY

DEVELOPED SPECIFICALLY FOR AIRCRAFT APPLICATION

A DOZEN ADVANTAGES RECOMMEND READING'S NEW AERO BATTERY

READING'S new AERO battery, developed after extensive research and experiment, and tested in READING'S own aircraft, is a definite advance in storage battery design and construction.

Although more electrolyte is used in this new battery, it is completely absorbed by the insulation. As a result the battery is non-spillable, even in inverted position. This improvement permits the elimination of the conventional air chamber above the plates, as employed in conventional design. The READING battery, consequently, has 25% more active plate surface and approximately 50% more active material—at no sacrifice of outside dimensions. Twenty-minute and five-hour ratings are increased proportionately.

The READING AERO battery is equipped with a self-ventilating hard rubber master cover which protects the terminals from dirt, oil, gasoline, etc. With this cover, and in view of the fact that it requires no drain, the battery need not be installed in the customary metal container. A metal band fitted into the moulded ribs of the battery box provides simple and secure installation.

There are other advantages to READING'S new AERO battery, such as: Difficult hydrometer readings are eliminated. Voltage readings may be taken while the battery is in position. Water may be added by simply removing the master cover. Evaporation is minimized.

We should like to send complete details of this vastly superior battery to every airplane owner, operator and manufacturer; as well as to the flying schools, repair stations, dealers, etc. Your request for additional information and prices will receive our prompt attention. No obligation involved.

The modern Reading factory produces thousands of storage batteries a month for aeronautical, automotive and industrial use in this and foreign countries More than 25 years experience in battery engineering is behind this latest product bearing the READING trade mark and guarantee, and is your warranty of satisfactory performance and durability.

Aeronautical Supply Houses—Write for READING'S Attractive Dealer Proposition

READING BATTERIES, INC.

Aircraft Division

READING • PENNSYLVANIA

BROWN MACHINERY CO.,
St. Louis, Mo.
Products: Lathes (10"). Rolling machines. Shearing machines (*Pexto*).

BROWN & SHARPE MFG. CO.,
Providence, R. I.
Products: Milling machines (horizontal; plain). Grinding machines (universal; tool; abrasive surface). Lathes (polishing; finishing). Bench centering machines. Gear hobbing machines.

Personnel: H. D. Sharpe, president and treasurer; H. Buker, vice-president and general sales manager; H. B. Shott.

BRYANT CHUCKING GRINDER COMPANY, Springfield, Vermont
Products: Grinders (internal; hole and face; up to 38" swing).

Personnel: R. E. Flanders, president; W. J. Bryant, vice-president; J. B. Johnson, chief engineer and assistant manager; J. E. Stetson, treasurer and manager; M. H. Arms, designing engineer; L. C. Gilchrist, sales engineer.

BUFFALO FORGE COMPANY,
448 Broadway, Buffalo, N. Y.
Products: Sensitive bench drills. Heat treating furnaces. Shears. Punches.

THE BULLARD COMPANY,
Bridgeport, Conn.
Products: Vertical turret lathes (42"). Production machines (*Mult-Au-Matic* 6 and 8 spindle, 8" to 16").

Personnel: E. P. Bullard, president; E. C. Bullard, vice-president; J. W. Bray, vice-president and director of sales; E. P. Blanchard, sales manager.

BURKE MACHINE TOOL CO.,
Conneaut, Ohio
Products: Milling machines. Drill presses.

BUSS MACHINE WORKS,
Holland, Mich.
Products: Electric woodworking machinery (planers; surfacers; shapers; cabinet saw benches; tilting table combination saw).

Personnel: M. E. Dick, president; E. T. Cameron, vice-president.

C

CANEDY-OTTO MFG. CO.,
Chicago Heights, Ill.
Products: Presses (drill; hand punch). Drilling machines (bench; Otto).

Branch offices: 507 Broome St., New York, N. Y.; 955 Folsom St., San Francisco, Calif.

THE CANTON FOUNDRY & MACHINE COMPANY, Canton, O.
Products: Portable cranes.

S. W. CARD MANUFACTURING CO. (Division of Union Twist Drill Co.),
Mansfield, Mass.
Products: Taps. Dies. Screw plates.

Personnel: J. W. Rathbun, manager; T. W. MacKay, works manager.

THE CARLTON MACHINE TOOL COMPANY, Cincinnati, O.
Products: Radial drills (heavy duty 3′ to 8′ arm).

Personnel: J. C. Carlton, president and general manager.

R. L. CARTER COMPANY,
New Britain, Conn.
Products: Hand type routers.

CEDAR RAPIDS ENGINEERING COMPANY OF DELAWARE,
902 17 Street, Cedar Rapids, Iowa
Products: *Kwik-Way* cylinder boring machines. Piston grinding machines. Cam piston grinders. Valve facing machines. Valve reseating tools. Seat replacement tools. Valve seat grinders. Cylinder adapter stands.

Personnel: R. H. Meister, president; T. M. Jones, vice-president.

CHAMPION BLOWER & FORGE COMPANY, Lancaster, Pa.
Products: Engine lathes (10" to 16"). Drills (upright; bench). Forges. Blowers. Screw cutting lathes. Bench shears. Power hack saw machines. Steel punches. Power hammers. Arbor presses. Saws (bench; jig; circular and jointer; bench band). Thread cutting machines. Grinders and buffers. Bench planers and jointers. Vises. Angle benders. Screw dies and taps. Spring dies. Fans (blowers and exhaust; ventilating and automatic shutter). Fan unit heaters.

Personnel: C. B. Long, president; E. Donohoe, vice-president; Frank Groff, factory superintendent.

CHAMPLIN BOX CO.,
Hartford, Conn.
Products: Disassembly racks.

CHICAGO PNEUMATIC TOOL CO.,
Chicago, Ill.
Products: Air grinders.

THE CINCINNATI BICKFORD TOOL CO., Cincinnati, Ohio
Products: Drilling machines (single and multiple spindle press; bench; radial press; plain radial).

THE CINCINNATI ELECTRIC TOOL CO., Cincinnati, Ohio
Products: Floor grinders.

CINCINNATI MILLING MACHINE & CINCINNATI GRINDERS, INC.,
Cincinnati, Ohio
Products: Milling machines (Universal L-type; plain and vertical high-speed dial type; plain automatic and hydromatic; duplex hydromatic). Duplex vertical hydro-broach machines. Grinders (universal tool and cutter; centerless; self-contained; plain hydraulic; roll; chucking). Centerless lapping machines. Hydraulic profile and die sinking machines. Milling machine attachments.

Branch offices: 2400 W. Madison St., Chicago, Ill.; Marburg and South Sts., Cincinnati, Ohio; 5005 Euclid Ave., Cleveland, Ohio; New Center Bldg., Detroit, Mich.; Chamber of Commerce Bldg., Pittsburgh, Pa.

Personnel: Frederick V. Geier, president; W. W. Tangeman, vice-president.

THE CINCINNATI SHAPER CO.,
Cincinnati, Ohio
Products: Die milling machines. Shapers (traverse; *Climax* universal). Press brakes. Sensitive radial drills.

THE CLEVELAND AUTOMATIC MACHINE CO., Cleveland, Ohio
Products: Automatic single and multiple spindle turret machines. Branch offices: 565 W. Washington Blvd., Chicago, Ill.; 30 Church St., New York, N. Y.; 2842 W. Grand Blvd., Detroit, Mich.

Personnel: W. F. Brown, president; A. L. Patrick, executive vice-president and treasurer; H. E. Nunn, vice-president; C. W. Cowdrey, sales manager.

THE CLEVELAND PLANER CO.,
Cleveland, O.
Products: Planing machines.

THE CLEVELAND PNEUMATIC TOOL CO., Cleveland, O.
Products: Riveters (pedestal; bench; yoke). Hose fittings. Blow and spray guns. Air valves. Riveting hammers. Portable air drills and grinders, polishers. Dural riveters. Rotary sanders. Pneumatic engine starters.

Branch offices: 30 Church St., New York, N. Y.; 80 Federal St., Boston, Mass.; 401 N. Broad St., Philadelphia, Pa.; Clark Bldg., Pittsburgh, Pa.; Insurance Exchange Bldg., Detroit, Mich.; Railway Exchange Bldg., Chicago, Ill.; Railway Exchange Bldg., St. Louis, Mo.; 1306 N. 1st Ave., Birmingham, Ala.; 1307 E. 17th St., Columbus, Ohio.

Personnel: Claus Greve, chairman of the board; L. W. Greve, president; H. W. Foster, vice-president; A. F. Barner, secretary; J. DeMooy, treasurer; S. Scott, superintendent; E. W. Cleveland, manager automotive-aircraft division.

CLEVELAND TWIST DRILL CO.,
1242 E. 49th St., Cleveland, O.
Products: Reamers.

CLEVELAND UNIVERSAL JIG CO.,
Cleveland, Ohio
Products: Standard drill fixtures.

COCHRANE-BLY COMPANY,
St. James St., Rochester, N. Y.
Products: Duplex universal vertical miller and shapers. Universal vertical milling machines. Universal vertical shapers. Circular tables. Metal sawing machines. High speed cutting-off machines. Automatic high speed saws. Automatic saw sharpening machines. Filing machines (bench; floor).

COLCORD-WRIGHT MACHINERY CO., St. Louis, Mo.
Products: Lathes (*Monarch* 18").

COLONIAL BROACH CO.,
Detroit, Mich.
Products: Broaches.

CONE AUTOMATIC MACHINE CO., INC., Windsor, Vermont
Products: Lathes (*Conomatics* ⅞" to 6"; universal multiple spindle automatic). Attachments.

CONSOLIDATED MACHINE TOOL CORP., Rochester, N. Y.
(Modern Tool Works Division)
Products: *Modern Magic* chucks and collets. Die heads (stationary; rotary). Collapsible taps. Stud setters. Inserted blade face milling cutters.

CONTINENTAL MACHINE SPECIALTIES, INC., Minneapolis, Minn.
Products: Continuous band filing and band sawing machines.

CONTINENTAL TOOL WORKS,
5435 McGraw St., Detroit, Mich.
Products: Counterboring machines (spotfacers; backspotfacers). Core drills. Hollow milling machines. Reamers. Tools (high-speed; circular forming).

E. COREY & COMPANY,
65 W. Commercial, Portland, Me.
Products: Bench straightening machines.

THE CRESCENT MACHINE CO.,
Leetonia, Ohio
Products: Woodworking machiner (saw tables; jointers; band saws; grinders; lathes; scroll saws; borers and mortisers; portable shapers; universal wood workers; planers; swing cut-off saws).

Manufacturers of Machinery for Aircraft Production

Branch offices: 90 West St., New York, N. Y.
Personnel: W. G. Bess, vice-president; J. H. Thompson (New York).

THE CUSHMAN CHUCK CO., Hartford, Conn.
Products: Chucks (electric; hand operated).

Branch offices: 66 W. Broadway, New York, N. Y.; Monadnock Bldg., San Francisco, Calif.; 15 N. Jefferson St., Chicago, Ill.

Personnel: Managers: E. V. N. Myers (New York); A. L. Whittemore (Chicago); R. R. Vought (San Francisco).

D

DAVIS BORING TOOL CO., 6200 Maple Ave., St. Louis, Mo.
Products: Boring and reamer bars.

DAVIS KEYSEATER CO., Rochester, N. Y.
Products: Keyseaters and cutters (straight; tapered).
Personnel: E. A. Grenelle, manager.

DETROIT BORING BAR CO., Detroit, Mich.
Products: Boring and reamer bars.

DETROIT TAP & TOOL CO., Detroit, Mich.
Products: Taps.

THE DeVILBISS CO., Toledo, Ohio
Products: Spray paint and finishing systems (air compressors; hose; spray guns; pressure feed paint tanks; spray painting outfits; attachments; portable exhaust fans; exhaust chambers).

Personnel: A. D. Gutchess, president; F. A. Bailey, vice-president and general manager; W. F. Gradolph, vice-president in charge of sales; R. A. Guyer, sales manager, spray equipment and compressor division.

DeWALT PRODUCTS COMPANY, 699 New Holland Ave., Leola, Pa.
Products: Saw cutters (metal; tube).

DIAMOND MACHINE COMPANY, 9 Codding St., Providence, R. I.
Products: Grinding machines. Boring machines (bar).

HENRY DISSTON & SONS, INC., Philadelphia, Pa.
Products: *Disston* band saws (band knives; log band and band re-saws; narrow and wide band saws). Circular saws (grooving; inserted tooth; solid tooth). Metal cutting saws (band; inserted and solid tooth). Fitted saws and tools. Philbrick cutter heads.

Branch offices: Chicago, Ill.; Detroit, Mich.; Boston, Mass.; New Orleans, La.; Memphis, Tenn.; Bangor, Me.; Seattle, Wash.; Portland, Ore.; Vancouver, B. C.; San Francisco, Cal.

Personnel: Henry Disston, president; Frank Disston, Wm. D. Disston, S. Horace Disston, Jacob S. Disston, Jr., vice-presidents; David W. Jenkins, general sales manager; Ernest Query, manager of sales, Hardware Department; Walter H. Gebhart, manager of sales, Industrial Division; Mark Harris, export sales manager.

DRIES & KRUMP, Chicago, Ill.
Products: Brake bending machines.

DUMORE COMPANY, Racine, Wisc.
Products: Portable flexible shaft tools (midget grinders; precision drills). Motors (polishing and buffing; small electric).

Branch offices: 15 Laight St., New York, N. Y.

Personnel: L. J. LaMack, assistant sales manager; F. E. Broberg and S. E. Peters, electrical engineers; L. B. Augustine, sales manager in charge of tool division; H. E. Nelson, factory manager.

E

EARLE GEAR & MACHINE CO., 4723 Stenton Ave., Philadelphia, Pa.
Products: Sawing machines.

EASTMAN MACHINE COMPANY, 779 Washington St., Buffalo, N. Y.
Products: Portable cloth cutting machines.

Branch offices: 85 Beach St., Boston, Mass.; 1115 Broadway, New York, N. Y.; 626 Arch St., Philadelphia, Pa.; 815 Van Buren St., Chicago, Ill.; 86 Third St., San Francisco, Calif.; 505 Iberville St., New Orleans, La.; Box 713, Charlotte, N. C.; 159 Pryor St., S. W., Atlanta, Ga.; 425 W. Jefferson Ave., Detroit, Mich.

Personnel: Wade Stevenson, president; V. E. McCollum, assistant secretary.

THE EASTERN MACHINE SCREW CORP., New Haven, Conn.
Products: Threading machines. Die heads (self opening; insert chaser).

Personnel: B. P. Greene, president and general manager; H. A. Hall and W. G. Redfield, vice-presidents; C. W. Bettcher, secretary and sales manager.

ECLIPSE AIR BRUSH CO., 79 Orange St., Newark, N. J.
Products: Air brushes and tanks.

ECLIPSE AVIATION CORP., E. Orange, N. J.
Products: Starter and generator tool kits. Starter clutch test stands.
Factories: (foundry division) Little Falls, N. J.

Personnel: Charles Marcus, president; R. P. Lansing, vice-president; H. A. Gossner, secretary; W. J. Buettner, treasurer; C. H. Knoch, assistant secretary-treasurer; A. E. Raabe, sales manager and assistant secretary.

THE ELECTRIC FURNACE CO., Salem, Ohio
Products: Industrial furnaces for nitriding, heat treatment, carburizing, enameling (oil; gas; electric).

Personnel: R. F. Benzinger, vice-president; A. H. Vaughan, chief engineer; T. B. Bechtel, sales engineer.

ELLIOTT & STEPHENS, St. Louis, Mo.
Products: Lathes.

CHAS. F. ELMES ENGINEERING WORKS, Chicago, Ill.
Products: Forcing presses.

ENGINEERING & RESEARCH CORP., Washington, D. C.
Products: *Erco* sheet metal formers. Propeller profiling machines. Automatic punch and riveting machines.

Personnel: Henry A. Berliner, president. Engineering; James Lee Simmons, Frank B. Levy, Edward M. Bertran, Lee L. Marchant. W. T. Queen, factory manager; A. J. Moore, superintendent of production, propeller profiling department; Charles Snyder, airplane development department. John D. Smoot.

ERRINGTON MECHANICAL LABORATORIES, Stapleton, S. I., N. Y.
Products: Automatic chucks.

ETNA MACHINE CO., Toledo, Ohio
Products: Sawing machines.

EX-CELL-O AIRCRAFT & TOOL CORP., Detroit, Mich.
Products: Grinders (precision thread; carbide tool). Precision boring machines. Milling and drilling heads. Hydraulic power units. Special multiple equipment. Diesel fuel injection equipment. Special tools. Drill jib bushings. Spindles (grinding; motorized).
(Continental Tool Works Division): Broaches and broaching fixtures. Milling cutters. Counterbores. Core drills. Special tools. Reamers. Counterbore sets. Carboloy tipped tools.

Branch offices: 1807 Elmwood Ave., Buffalo, N. Y.; Penton Blvd., Cleveland, O.; 522 Grand Ave., Dayton, O.; Dodge Bldg., New York, N. Y.

Personnel: N. A. Woodworth, president and general manager; W. F. Wise, sales manager.

EXCELSIOR TOOL & MACHINE CO., E. St. Louis, Ill.
Products: Single spindle press drills.

F

FAY AUTOMATIC MACHINE TOOL COMPANY, Springfield, Vt.
Products: Lathes (engine, 4 spindle automatic; special).

J. A. FAY & EGAN COMPANY, Cincinnati, O.
Products: Molders. Saws.

THE FELLOWS GEAR SHAPER COMPANY, Springfield, Vt.
Products: Gear shapers (high speed; heavy duty). Generators (thread; hourglass). Gear burnishing machines. Gear lapping machines. Helical gear shaper cutters. Automatic gear inspection machines. Measuring machines (involute; gear).
Branch office: Fisher Bldg., Detroit, Mich.

Personnel: E. R. Fellows, president and general manager; W. D. Woolson, vice-president; W. F. Slomer, general sales manager (Detroit); E. W. Miller, chief engineer; E. Stubbs, factory manager.

R. Y. FERNER COMPANY, Washington, D. C.
Products: Boring, drilling and milling machines (vertical).

FERRACUTE MACHINE CO., Bridgeton, N. J.
Products: Presses (foot; hand).

FIRTH-STERLING COMPANY, 710 W. Lake St., Chicago, Ill.
Products: Tungsten carbide tools.

THE FLATHER COMPANY, Nashua, N. H.
Products: Engine lathes.

THE FOOT-BURT COMPANY, 13010 St. Clair, Cleveland, Ohio
Products: Drilling machines (single and multiple spindle; special). Drill presses.

FOSDICK MACHINE TOOL CO., Cincinnati, O.
Products: Heavy duty upright drilling and tapping machines.

FOSTER MACHINE CO., Elkhart, Ind.
Products: Turret lathes. Screw machines.

(Continued on following pages)

Manufacturers of Machinery for Aircraft Production (Continued)

THE FOSTORIA PRESSED STEEL CORP., Fostoria, Ohio
Products: *Sorwal* coolant filters. *Tite Seal.* Machine lamp.

Personnel: C. D. Pifer, president and general manager; R. J. Carter, secretary and treasurer; C. W. McDaniel, general sales manager; Burtron Zook, sales promotion manager.

FOUNDRY EQUIPMENT CO., 1833 Columbus Rd., Cleveland, O.
Products: Ovens (core; fuel; oil).

FOX MACHINE COMPANY, Jackson, Mich.
Products: Presses.

CHARLES E. FRANCIS CO., Rushville, Ind.
Products: Glue pots, mixers, spreaders, clamps. Hand screws. Hydraulic glue presses. Veneer ironing presses. Coating and painting machines.

Personnel: George J. Griesser, president; M. A. Francis, vice-president.

G

THE GAIRING TOOL CO. Detroit, Mich.
Products: Cutting tools (blades; boring heads; core drills; counterbores; countersinks; spotfacers; end mills; twist drills; reamers; tungsten-carbide tipped tools). Tool holders.

Personnel: E. Gairing, president; B. O'Meara, sales manager; D. G. Hawksworth, machine engineer; W. B. McClellan, sales engineer.

GALLMEYER & LIVINGSTON CO., Grand Rapids, Mich.
Products: Grinding machines. Cutting machines. Tools.

THE GAMMONS-HOLMAN CO., Manchester, Conn.
Products: Punching and shearing machines.

GARDNER MACHINE CO., Beloit, Wisc.
Products: Grinding machines (disc; automatic; special; ring-wheel; pattern maker's disc). Polishing lathes. Band finishing machines. Heavy type G. I. A. discs. Chucks. Fixtures. Cement. Grinding compounds. Attachments.

W. GATEMANN MFG. CO., Manatowoc, Wisc.
Products: Pneumatic oscillating tapping machines.

THE GEHNRICH CORP., Long Island City, N. Y.
Products: Industrial ovens and dryers. Air heaters. Attachments.
Personnel: A. V. Maday, president; A. H. Sherman, vice-president and chief engineer. H. C. Hammer, superintendent.

GENERAL ELECTRIC CO., Schenectady, N. Y.
Products: Motors and turbines. Industrial control apparatus (switches; starters; rheostats; controllers; contactors; relays; pressure governors; push button stations). Switch-gear. Transformers. Lighting arresters. Fuse cut-outs. Voltage regulators. Capacitors. Instruments and meters. Electric welding equipment (electrodes; accessories). Industrial heating equipment (box-type furnaces for hardening, annealing, carburizing; electric glue pots). Cable wire and wiring material. Dynamometers. Battery charging equipment. Laboratory products. Plastic products. Industrial X-ray units. Carboloy tools, dies and inserts. Electrical appliances. Air conditioning equipment. Electric refrigeration equipment.

Branch offices: In principal cities.

Personnel: (Aeronautical division) J. C. Miller, manager; H. C. Ritchie and E. G. Haven. Aviation specialists: T. B. Jacocks (Washington); C. E. Anthony (New York); R. B. Ranson (Hartford); R. E. Johnson (Los Angeles); J. Bosway (Dayton).

THE GEOMETRIC TOOL CO., New Haven, Conn.
Products: Threading machines. Die heads (self-opening and solid adjustable; circular and tangent chaser). Taps. Cutting tools.

Personnel: J. W. Hook, president; J. W. Sneyd, vice-president; G. A. Denison, sales manager; A. F. Breitenstein, chief engineer and works manager.

GISHOLT MACHINE CO., Madison, Wisc.
Products: Lathes (Simplimatic turret; precision and heavy duty, 10″ to 32″). Balancing machines (dynamic; static). Universal tool grinders.

Branch offices: 2400 West Madison St., Chicago, Ill.; General Motors Bldg., Detroit, Mich.; 1060 Broad St., Newark, N. J.; 39 Montclair Drive, W. Hartford, Conn.; 253 Sagamore Rd., Brookline, Upper Darby, Pa.; 1888 Page Ave., Cleveland, O.; 1914 N. 51 St., Milwaukee, Wisc.; 359 Kenilworth Ave., Dayton, O.

Personnel: H. S. Johnson, president; F. W. Coombs and C. H. Johnson, vice-presidents; G. H. Johnson, vice-president and treasurer; W. J. Hannum, sales manager.

GLEASON WORKS, Rochester, N. Y.
Products: Gear generators.

GORHAM TOOL COMPANY, Detroit, Mich.
Products: High speed tools.

GOSS & deLEEUW MACHINE CO., New Britain, Conn.
Products: Chucking machines (4-spindle).

GEORGE GORTON MACHINE CO., Racine, Wisc.
Products: Vertical milling machines.

GOULD & EBERHARDT, Newark, N. J.
Products: Milling machines (helical; spur). Shapers. Hobbing machines.

GRAND MANUFACTURING & MACHINE CO., Bridgeport, Conn.
Products: Drilling machines (upright; multiple spindle).

GRAND RAPIDS MACHINE CO., Grand Rapids, Mich.
Products: Drill grinders.

THE G. A. GRAY CO., Cincinnati, Ohio
Products: Nibbling machines (sheet metal cutters). Planers.

GREAVES-KLUSMAN TOOL CO., Cincinnati, Ohio
Products: Engine lathes.

GREENERD ARBOR PRESSES, Nashua, N. H.
Products: Arbor presses (hand operated; motor driven; hydraulic; 15 lbs. to 40 tons).
Personnel: Warren L. Martin, general manager.

GREENFIELD TAP & DIE CORP., Greenfield, Mass.
Products: Woodworking lathes. Taps.

Personnel: E. C. Bailey.

H

HALL & BROWN MACHINE CO., 1915 N. Broadway, St. Louis, Mo.
Products: Nibbling machines. Punch presses. Sanders. Rip saws.

THE HALL PLANETARY CO., Philadelphia, Pa.
Products: *Planetary* milling machines.

Personnel: P. Hall, president; H. C. Sheaffer.

HANNIFIN MANUFACTURING CO., 621 S. Kolmar Ave., Chicago, Ill.
Products: Portable hydraulic riveters (*Hy-power*). Special riveting machines.

Personnel: V. W. Peterson, president.

THE HANSON-WHITNEY MACHINE CO., Hartford, Conn.
Products: Thread millers and accessories. Taps.

HARDINGE BROTHERS, INC., Elmira, N. Y.
Products: Precision bench lathes (32″ to 36″). Precision milling machines. Precision hand screw machines. Precision screw cutting lathes. Collets.
Branch offices: 544 W. Washington Blvd., Chicago, Ill.; 2970 W. Grand Blvd., Detroit, Mich.; 277 Lafayette St., New York, N. Y.

Personnel: D. G. Anderson, president; L. R. Evans and D. R. Laux, vice-presidents; D. W. Strom, mechanical engineer.

HARNISCHFEGER CORPORATION, Milwaukee, Wisc.
Products: Electric arc welders. Electric hoists. Electric motors. Cranes (electric overhead traveling; crawler).
Branch offices: 20 N. Wacker Drive, Chicago, Ill.; 2223 Commerce St., Dallas, Tex.; 452 Book Bldg., Detroit, Mich.; 1714 Willow Ave., Hoboken, N. J.; 18 W. 34th St., Indianapolis, Ind.; 1052 E. Bay St., Jacksonville, Fla.; 523 Dwight Bldg., Kansas City, Mo.; 2029 Santa Fe Ave., Los Angeles, Cal.; 307 S. Front St., Memphis, Tenn.; 2511 Empire State Bldg., New York, N. Y.; 1385 Broad St., Station Bldg., Philadelphia, Pa.; 2121 Farmers Bank Bldg., Pittsburgh, Pa.; 82 Beale St., San Francisco, Cal.; 2911 First Ave., S., Seattle, Wash.; 1031 Tower Bldg., Washington, D. C.

Personnel: W. Harnischfeger, president; C. W. Daniels, general sales manager; F. J. Wollaeger, Jr., welder sales manager; G. L. Drake, hoist sales manager; H. H. Erkelenz, works manager; B. Van Horn, crane sales manager.

HARRON RICKARD & McCONE CO., San Francisco, Calif.
Products: Milling machines.

R. G. HASKINS COMPANY, 4636 W. Fulton Street, Chicago, Ill.
Products: Portable flexible shaft machinery (grinders and attachments; sanders; polishers; rotary files, screw drivers; nut setters, right angle head). Flexible shafts. Mountings. Tapping equipment.

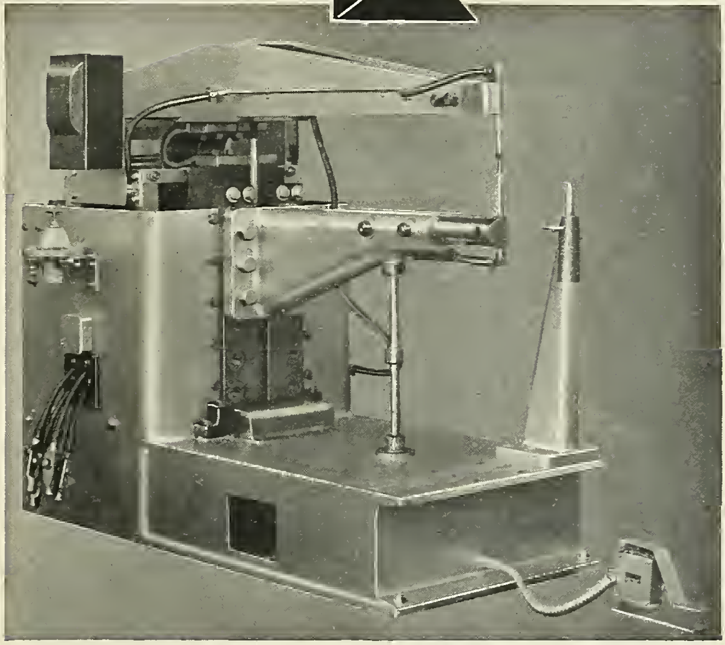
Personnel: R. G. Haskins, president; E. P. Grismer, sales manager.

C. I. HAYES, 129 Baker, Providence, R. I.
Products: Furnaces.

HAYNES STELLITE CO., New York City, N. Y.
Products: Metal cutting tools.

(Continued on following pages)

ANOTHER Federal DEVELOPMENT



Machines for Welding Aluminum and Aluminum Alloys with Consistent Uniformity of Quality

FEDERAL'S engineering staff has had extensive experience in the development of welding equipment to meet individual aeronautical requirements. Consult our engineers freely if you are faced with a difficult welding problem of your own.

PRODUCTION managers in charge of metal work agree that one of the most important units of machinery equipment is a spot welder for aluminum and aluminum alloys, which will turn out welds of a consistently uniform quality. « The Federal machine engineers, in collaboration with aeronautical engineers, have designed and produced machines for this type of work which today are operating with a remarkable degree of success in several prominent aircraft factories, as well as at Wright Field, Dayton, Ohio. The unit illustrated above, for instance, was developed for Chance Vought Aircraft, and has been in constant use on production work since early in October. « Our experience with the aircraft industry indicates that each manufacturer's problems require special machine design. This we are equipped to provide with facility, at the same time guaranteeing in each design the major requirements of spot welding machines—**(a)** Sufficient welding capacity with wide range of regulation in fine increments **(b)** Sufficient pressure with proper regulation **(c)** Low inertia of the moving electrode assembly to prevent hammer blow **(d)** Suitable electrode design **(e)** Synchronous electronic timing equipment. « Complete design and functional details of FEDERAL welding machines are available to aircraft, engine and accessory manufacturers. Your inquiries will receive our prompt and cooperative attention.

Recognized Leaders in the Development and Production
of All Types of Resistance Welders.

THE FEDERAL MACHINE & WELDER CO.
Warren, Ohio

MANUFACTURERS OF ALL TYPES OF SPOT, PROJECTION, BUTT, FLASH AND SEAM WELDERS

Branch offices: Chicago, Ill.; Cleveland, O.; Detroit, Mich.; Houston, Tex.; Los Angeles, Calif.; San Francisco, Calif.; Tulsa, Okla.

THE HEALD MACHINE CO., Worcester, Mass.
Products: Grinding machines (*Sizematic* and *Bore-matic;* internal; dry surface; cylinder; rotary surface).

Branch offices: Chicago, Ill.; Cleveland, O.; Detroit, Mich.; New York, N. Y.; Philadelphia, Pa.; Syracuse, N. Y.

HENDEY MACHINE COMPANY, 105 Summer St., Torrington, Conn.
Products: Engine lathes. Milling machines.

HESTON & ANDERSON, Fairfield, Iowa
Products: Jointers. Saws.

HEVI DUTY ELECTRIC CO., Milwaukee, Wisconsin
Products: Electric heat treating furnaces.

Branch offices: 205 W. Wacker Drive, Chicago, Ill.; 26 S. 15th St., Philadelphia, Pa.; 148 Crestwood Ave., Buffalo, N. Y.; 2281 Scranton Rd., Cleveland, Ohio.

Personnel: E. L. Smalley, president; H. E. Koch, vice-president and general manager.

THE HIGH SPEED HAMMER COMPANY, INC., Rochester, N. Y.
Products: High speed riveters.

HISEY-WOLF MACHINE CO., Cincinnati, Ohio
Products: Electric buffing and polishing machines.

HJORTH LATHE & TOOL CO., 12 Beacon Street, Woburn, Mass.
Products: Precision bench lathes. Spring winders. *B-ver* expansion reamers. Gauges (micrometer depth; drill angle testing; micrometer surface). Attachments.

Personnel: Henrick J. Hjorth, president and general manager.

HOEFER MANUFACTURING CO., 20 Liberty St., Freeport, Ill.
Products: Multiple drill heads (fixed; adjustable).

HORN DEVICE MFG. CO., Kenmore, O.
Products: Power band saw.

HOSKINS MANUFACTURING CO., 4435 Lawton Ave., Detroit, Mich.
Products: Furnaces.

HUNTER & HAVENS, Hartford, Conn.
Products: Electric driven valve refacers.

HUTCHINSON MFG. CO., Morristown, Pa.
Products: Combination saws and jointers.

I

IDEAL MACHINERY CO., Plainville, Conn.
Products: Engine lathes.

INDEPENDENT PNEUMATIC TOOL CO., Chicago, Ill.
Products: *Thor* portable electric tools (drills; screw drivers; nut setters; saws; grinders; hammers). Electric bench grinders. Drill stands. Centering devices. Angle attachments.

Branch offices: 915 N. 7th Ave., Birmingham, Ala.; Little Bldg., Boston, Mass.; Genesee Bldg., Buffalo, N. Y.; 1740 E. 12th St., Cleveland, Ohio; Garfield Bldg., Detroit, Mich.; 6200 E. Slauson Ave., Los Angeles, Calif.; 342 N. Water St., Milwaukee, Wisc.; 330 W. 42d St., New York, N. Y.; 401 N. Broad St., Philadelphia, Pa.; 320 Penn Ave., Pittsburgh, Pa.; 408 Pine St., St. Louis, Mo.; 290 Seventh St., San Francisco, Calif.

Personnel: N. C. Hurley, president; R. S. Cooper, G. H. McCrae, F. B. Hamerly, and W. A. Nugent, vice-presidents.

THE INGERSOLL MILLING MACHINE CO., Rockford, Ill.
Products: Automatic milling machines.

J

JONES & LAMSON MACHINE CO., Springfield, Vt.
Products: Lathes (*Fay* automatic 8″ to 24″; turret). Automatic double end milling and centering machines. Automatic dies (radial; tangential). Optical inspection machines (comparators; measuring).

Branch offices: 2832 E. Grand Blvd., Detroit, Mich.; 2400 Madison Ave., Chicago, Ill.

Personnel: R. E. Flanders, president; K. H. Woolson, vice-president; J. E. Lovely, chief engineer.

K

KELLY REAMER CO., Cleveland, Ohio
Products: Bars (boring; reamer).

KEARNEY & TRECKER CORP., Milwaukee, Wisc.
Products: Milling machines and attachments. Tungsten carbide cutters and cutter grinders.

Personnel: Theodore Trecker, president; Philip Edwards, vice-president; G. L. Erwin, general sales manager.

KINGSBURY MACHINE TOOL CORP., Keene, New Hampshire
Products: Drilling machines (production semi-automatic). Automatic indexing machines for drilling, milling, threading. Automatic drilling and tapping machines. Center column type machines. Adapter units.

Personnel: E. J. Kingsbury, president and treasurer; G. Swahnberg, vice-president.

JAMES H. KNAPP COMPANY, INC. Los Angeles, Calif.
Products: Industrial furnaces (tool; heat treating; carburizing; nitriding). Forges.

Personnel: James H. Knapp, president.

W. B. KNIGHT MACHINE CO., Lucas Ave., St. Louis, Mo.
Products: Milling machines.

KUTMORE TOOL COMPANY, 841 Lake Ave., Rochester, N. Y.
Products: Adjustable hollow-mills and resharpening fixtures.

Personnel: George Reisinger; general manager; B. J. Wolfe, chief engineer; L. Tardier, purchasing agent.

L

LANDIS TOOL CO., Waynesboro, Pa.
Products: Grinding machines (piston; cam; cylindrical plain; universal special). Attachments. Thread chasers.

Branch offices: Detroit, Mich.; Chicago, Ill.; Newark, N. J.; Philadelphia, Pa.

LANGELIER MFG. CO., Providence, R. I.
Products: Semi-automatic drills.

LA POINTE MACHINE TOOL CO., Hudson, Mass.
Products: Broaches.

LA SALLE MACHINE WORKS, Chicago, Ill.
Products: Small punch presses.

THE R. K. LeBLOND MACHINE TOOL CO., Cincinnati, O.
Products: Lathes (*Multi-Cut* 6″ to 12″; *Eleven Inch* rapid production; automatic 12″ to 16″). Branch offices: Wacker Drive Bldg., Chicago, Ill.; 30 Church St., New York, N. Y.

Personnel: R. K. LeBlond, president; W. F. Groene, vice-president and chief engineer; H. C. Pierle, secretary and sales manager; R. E. LeBlond, works manager. Representatives: B. N. Brockman (Chicago); W. E. Groene (New York).

LEEDS & NORTHRUP COMPANY, 4903 Stenton Ave., Philadelphia.
Products: Electric furnaces (heat treating; hump; homo). Pyrometers. Recorders. Controller (frequency). Combustion control. Wheatstone bridges.

THE LEES-BRADNER COMPANY, Cleveland, Ohio
Products: Hobbers (production gear; multiple spindle rotary automatic; single spindle automatic). Generators (gear; worm gear). Thread millers (standard; collet; super duty). Universal gear tooth grinder. Testers (gear; lead or helix angle).

Personnel: H. T. Bradner, president; W. A. McCarrell, sales manager; C. H. Schurr.

LEHMAN MACHINE COMPANY, St. Louis, Mo.
Products: Engine lathes.

LELAND-GIFFORD COMPANY, Worcester, Mass.
Products: Drilling machines (single and multiple spindle; press; gang press).
Branch offices: Boston, Mass.; Chicago, Ill.; Cleveland, O.; Detroit, Mich.; New York, N. Y.; Pittsburgh, Pa.; Rochester, N. Y.

LODGE & SHIPLEY MACHINE TOOL CO., Cincinnati, Ohio
Products: Lathes (manufacturing; automatic; precision, 14″ to 36″). Attachments.

Personnel: M. G. Lodge, president; J. W. Carrel, vice-president and general manager.

LUCAS MACHINE TOOL CO., 523 E. 99th St., Cleveland, O.
Products: Horizontal boring mills.

M

McCROSKY TOOL CORP., Meadville, Pa.
Products: Reamers.

MADISON MFG. COMPANY, Muskegon, Mich.
Products: Bars (boring; reamer).

MANNING, MAXWELL & MOORE, 100 E. 42nd St., New York, N. Y.
Products: Vertical drilling machines.

W. B. MERSHON & CO., Saginaw, Mich.
Products: Band saws.

MICHIGAN TOOL COMPANY, 147 Jos. Campau St., Detroit, Mich.
Products: Hobbers (spline). Circular form tools.

MICRO MACHINE COMPANY, Bettendorf, Iowa
Products: Cylinder grinding machines.

Manufacturers of Machinery for Aircraft Production (Continued)

THE ALEXANDER MILBURN CO., 1416 W. Baltimore St., Baltimore, Md.
Products: Welding and cutting apparatus (oxy-acetyle; cutting and welding tips). Paint spray equipment. Portable carbide lights. Air and gas purifiers.

Branch offices: Bourse Bldg., Philadelphia, Pa.; 130 W. 42nd St., New York, N. Y.; 50 Terminal St., Boston, Mass.

Personnel: A. F. Jenkins, president and treasurer; Wm. Patterson, sales promotion department; C. R. Heckler, factory superintendent; J. G. Henderson, engineer; J. A. Griffith, tool room foreman.

MILLERSBURG REAMER & TOOL CO., INC., Millersburg, Pa.
Products: Reamers.

MINISTER MACHINE CO., Minister, Ohio
Products: Heavy duty drilling machines.

MODERN TOOL WORKS Rochester, N. Y.
Products: Chucks. Collets Die heads. Taps. Milling cutters. Stud setters.

MOLINE TOOL CO., Moline, Ill.
Products: Vertical borers. Lapping machines.

MONARCH MACHINE TOOL CO., Sidney, Ohio
Products: Lathes (engine, 12" to 36"; tool room, 12" to 18"; manufacturing; *Magna-Matic* universal; small production; high speed manufacturing). Centrode and oval chucks.

Personnel: W. E. Whipp, president; F. C. Dull, vice-president and secretary; P. A. Abe, works manager; C. F. Bickel, chief engineer.

GEORGE E. MOORE, 44 Farnsworth St., Boston, Mass.
Products: Presses.

MORRIS MACHINE TOOL CO., Cincinnati, Ohio
Products: Drilling machines (*Mor-speed* radial; heavy duty).

MOTCH AND MERRYWEATHER MACHINE CO., Cincinnati, O.
Products: Radial drills.

MUCHEY MACHINE & TOOL CO., 952 Porter St., Detroit, Mich.
Products: Grinding machines.

MUMMERT-DIXON COMPANY, Hanover, Pa.
Products: Grinders (portable radial; tool; suspended). *Buldog* boring heads. Spot facing tools. Facing heads. Pattern making machinery.

Personnel: E. S. Mummert, president and general manager; L. W. Rohrbaugh, vice-president; J. W. Rohrbaugh, director. D. H. Frock, sales.

N

NATIONAL ACME COMPANY, Cleveland, O.
Products: Automatic screw machines.

NATIONAL BROACH & MACHINE COMPANY, Detroit, Mich.
Products: Gear machines (*RedRing*. shaving lappers; speeders; universal checkers).

Personnel: R. S. Drummond, president.

NATIONAL MACHINE TOOL CO., Spring Grove Ave., Cincinnati, O.
Products: Drilling machines (*Natco* multi; automatic).

NATIONAL TOOL COMPANY, Cleveland, O.
Products: Chucks (automatic; quick changing).

NATIONAL TWIST DRILL CO., 6522 Brush St., Detroit, Mich.
Products: Reamers.

NEW ADVANCE MACHINE CO., Van Wert, Ohio
Products: Wood shapers.

NEWARK GEAR CUTTING MACHINE CO., 69 Prospect St., Newark, N. J.
Products: Gear cutting machines.

THE NEW BRITAIN-GRIDLEY MACHINE CO., New Britain, Conn.
Products: Chucking machines and chucking units (automatic; hydraulic). Automatic-type machines (screw; tube).

Branch offices: General Motors Bldg., Detroit, Mich.; 2400 W. Madison St., Chicago, Ill.

Personnel: H. H. Pease, president and treasurer; E. L. Steinle, vice-president and sales manager; D. H. Montgomery, vice-president and chief engineer; R. S. Hose, vice-president and assistant treasurer.

NEW ENGLAND BLOWER CO., Hartford, Conn.
Products: Spray booths.

NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y.
Products: Shearing machines (foot; power; squaring; power squaring; power gap). Power beading machines. Rolling machines. Cadmium plating equipment.

W. H. NICHOLSON & CO., Wilkes-Barre, Pa.
Products: Mandrels.

NIELSEN, INC., Lawton, Michigan
Products: Centers, tail stock spindles for lathes, grinders and other tools.

Personnel: W. W. Gairing, manager and chief engineer.

JOHN J. NORMOYLE CO., Moline, Ill.
Products: Sheet metal shears.

NORTON COMPANY, Worcester, Mass.
Products: Grinding machines (cylindrical; semi-automatic cylindrical; external surface; special). Power traverse machines.

O

OESTERIEIN MACHINE CO., 3301 Colerain, Cincinnati, O.
Products: Grinders. Milling machines.

THE OILGEAR COMPANY, Milwaukee, Wisc.
Products: Horizontal oilgear broaches.

OLIVER INSTRUMENT COMPANY, Adrian, Michigan
Products: Die making machines. Grinders (twist drill; face mill; full automatic face mill).

Personnel: E. C. Oliver president.

OLIVER MACHINERY CO., Grand Rapids, Mich.
Products: Electric motors. Saws (circular; jig). Benches and tables. Boring machines. Carving machines. Clamps. Glue spreaders. Grinders. Hand planers and jointers. Lathes (pattern makers' 16" to 30"; speed 8" to 12"; wood turning 32" to 96"). Milling machines. Mortisers. Moulders. Pattern shop accessories. Planers. Routers. Sanders. Shapers. Tenoners. Trimmers. Vises.

Branch offices: 50 Church St., New York, N. Y.; Bank of Commerce Bldg., St. Louis, Mo.; Sexton Bldg., Minneapolis, Minn.

Personnel: M. D. Baldwin, vice-president and factory manager; A. S. Kurkjian, sales manager; H. B. Tuthill, purchasing agent and plant manager.

TINIUS OLSEN TESTING MACHINE CO., Philadelphia, Pa.
Products: Testing machines.

ONSURD MACHINE COMPANY, Chicago, Ill.
Products: Routers.

KENT OWENS MACHINE CO., 958 Wall St., Toledo, Ohio
Products: Horizontal milling machines. Lathes. Planers. Joiners. Millers.

P

PANGBORN CORPORATION, Hagerstown, Md.
Products: Blast cleaning rooms. Blast cleaning hose machines. Blast cleaning cabinets. All-metal cloth screen dust collectors. Blast cleaning attachments and supplies. Exhausters and blowers.

Branch offices: 19 Orchard Terrace, Arlington, Boston, Mass.; 510 N. Dearborn St., Chicago, Ill.; 2634 Mayfield Rd., Cleveland, O.; Stephenson Bldg., Detroit, Mich.; 122 E. 42 St., New York, N. Y.; 246 W. Upsal St., Philadelphia, Pa.; Chamber Commerce Bldg., Pittsburgh, Pa.; Eckel Theatre Bldg., Syracuse, N. Y.

Personnel: T. W. Pangborn, president; J. C. Pangborn, vice-president and treasurer; P. J. Potter, vice-president; V. F. Stine, 2nd, vice-president and sales manager; W. A. Rosenberger, chief engineer; G. S. Goodrich, general superintendent (Philadelphia); L. W. Wagner (Chicago); C. A. Bultman (Detroit); W. F. Jones (New York City); R. M. Trent (Pittsburgh); B. R. Artz (Syracuse).

PARKER MACHINE WORKS, Riverside, Calif.
Products: Box nailing machines. Wire tying machines.

Personnel: G. M. Hill, general manager.

PASSCHE AIRBRUSH CO., Diversey Parkway, Chicago, Ill.
Products: Airfinishing units and accessories. Portable airpainting units and accessories.

Personnel: H. F. Reck, vice-president.

THE PECK, STOW & WILCOX CO., Southington, Conn.
Products: Shears (power and foot squaring; circular and flangers; slitting; ring and circular). Combination brake and folders. Power forming rolls. Slip roll formers. Bar folders. Power groovers. Deep throat beading machines. Power corrugating or beading machines. Electrical universal combination machines. Presses (twin; gap punch; double crank; inclinable). Power double seaming machines.

Branch offices: 157 Chambers St., New York, N. Y.

(Continued on following pages)

Personnel: Mark J. Lacey, president and general manager; W. O. Seifert, sales manager, machinery division.

PEERLESS MACHINE COMPANY,
1615 Racine St., Racine, Wisc.
Products: Metal sawing machines (standard and universal). Pipe threading machines.

Branch offices: 15 Warren St., New York, N. Y.

HENRY PELS & COMPANY,
90 West St., New York, N. Y.
Products: Hand slitting shears.

PENN RIVET CORPORATION,
Philadelphia, Pa.
Products: Riveting machines.

PERKINS MACHINE CO.,
Warren, Mass.
Products: Presses.

PETTINGELL MACHINE CO.,
Amesbury, Mass.
Products: Power hammers.

C. O. PORTER MACHINERY CO.,
Grand Rapids, Mich.
Products: Wood working machinery (planers; facers; jointers; routers; shapers; cut off saws; lathes; band saws; sanders). Cutter grinders.

Personnel: C. Oscar Porter, president; Clare O. Porter, vice-president and treasurer; John V. Cederlund, superintendent; B. E. Porter, engineer.

H. K. PORTER, INC., Everett, Mass.
Products: Bolt clippers. Cutters (chain; shear; bench; storage battery; wire). Nut splitters. Cutting tools.

Personnel: H. W. Porter, president and production manager.

PORTER-CABLE MACHINE CO.,
708 N. Salina St., Syracuse, N. Y.
Products: Disc sanders.

POTTER & JOHNSTON MACHINE CO.,
Pawtucket, R. I.
Products: Lathes (automatic). Screw machines. Universal shaping machines. Automatic chucking and turning machines.

PRATT & WHITNEY COMPANY,
Hartford, Conn.
Products: Jig borers. Centering machines. Die sinkers. Drills. Gear burnishers. Grinders. Lathes and attachments (13" to 20"). Millers. Profilers. Vertical shapers. Vertical automatics. Small tools (taps; dies; screw plates; cutters; reamers; punchers; drills; taper pins; rachet drills; lathe mandrels; threading tools; knurls and knurl sets; hand chasers; counter-borers, solid, interchangeable; mills; forming tools, flat, circular). Gages (*Hoke* precision blocks; micrometers; cylindrical and thread; transform snap; adjustable limit pin; camshaft comparator; level; taper; end; spline; star. Keller Division: automatic die cutting machines; automatic tool miller; *Kellerflex* finishers and attachments.

Branch offices: 564 W. Monroe St., Chicago, Ill.; 2d Ave. and 21st St., Birmingham, Ala.; 1433 E. 12th St., Cleveland, Ohio; 2035 Santa Fe Ave., Los Angeles, Calif.; 401 N. Broad St., Philadelphia, Pa.; 89 East Ave., Rochester, N. Y.; 917 Howard St., San Francisco, Calif.; 161 Brookline Ave., Boston, Mass.; 226 E. 9th St., Cincinnati, Ohio; 2836 E. Grand Blvd., Detroit, Mich.; 111 Broadway, New York, N. Y.; Grant Bldg., Pittsburgh, Pa.; 710 N. 12th Blvd., St. Louis, Mo.

Personnel: C. R. Burt, president and general manager; W. P. Kirk, vice-president in charge of sales; H. D. Tanner, manager, machinery division; C. M. Pond, manager, small tool and gage division; A. S. Keller, manager, Keller Division; A. H. d'Arcambal, sales manager, small tool and gage division; H. H. Wallace, purchasing agent.

THOMAS PROSSER & SON,
15 Gold St., New York, N. Y.
Products: Carbide cemented tools. Special grinders. Silicon carbide and diamond wheels. Wear resisting material.

Branch offices: 7310 Woodward Ave., Detroit, Mich.

PROVIDENCE ENGINEERING WORKS, INC., Providence, R. I.
Products: High speed single and multiple spindle drilling machines (bench; floor).

Personnel: W. A. Drewett, president and treasurer; R. H. Dunbar, vice-president.

Q

THE QUICKWORK COMPANY,
St. Marys, Ohio
Products: Hammers (power; bumping). Rotary shears. Hydraulic presses.

R

RACINE TOOL & MACHINE CO.,
1751 State St., Racine, Wisc.
Products: Saws (duplex band; power hack).

REED-PRENTICE CORP.,
Worcester, Mass.
Products: Lathes (precision; heavy duty; 14" to 20"). Routers and vertical milling machines. Vertical milling and die sinking machines. Die casting machines. Timber sawing machines (portable). Rotary and other attachments.

Branch offices: 125 Barclay St., New York, N. Y.

Personnel: C. L. Stevens, president; F. W. McIntyre, vice-president.

REISINGER MACHINE TOOL CORP.
Rochester, N. Y.
Products: Milling machines (inserted blade; hollow).

RELIANCE MACHINE SALES CO.,
Pittsburgh, Pa.
Products: Sensitive bench drills.

RICKERS-SHAFER CO., Erie, Pa.
Products: Thread chasers. Tapping machines.

RIVETT LATHE & GRINDER, INC.,
Brighton, Boston, Mass.
Products: Precision bench lathes and grinders. Precision back geared screw cutting lathes.

Personnel: T. S. Ross, president and general manager; F. C. Blanchard, vice-president and chief engineer.

W. ROBERTSON MACHINE & FACTORY CO., Buffalo, N. Y.
Products: Power saws.

THE ROWBOTTOM MACHINE CO.,
Waterbury, Conn.
Products: Polishing and buffing machines.

JOSEPH T. RYERSON & SON, INC.,
16th & Rockwell Sts., Chicago, Ill.
Products: Drilling machines (heavy duty).

Branch offices: Exchange Bldg., Kansas City, Mo.; Manufacturers' National Bank Bldg., Rockford, Ill.; 605 Washington Ave. N., Minneapolis, Minn.; 2035 E. 11 St., Tulsa, Okla.; State Bank Bldg., Rock Island, Ill.

S

W. J. SAVAGE COMPANY, INC.,
Knoxville, Tenn.
Products: Nibbling machines (nibbler; roller die, 9" to 36" throat).
Personnel: J. H. Murrian, president; J. A. Murrian, vice-president and general manager.

GEORGE SCHERR COMPANY,
128 Lafayette St., New York, N. Y.
Products: *Parkson* gear testing jigs. Hobbers (*Reinecker* full universal gear and pinion; high power). Grinding machines (*Reinecker* worm; universal tool). *Reinecker* tooth chamfering machines. *Reinecker* universal relieving lathes. *Zeiss* industrial measuring instruments (optimeter; circular division tester; optical dividing head; camshaft tester; toolmakers' microscope; universal measuring microscope).

SCINTILLA MAGNETO CO.,
Sidney, N. Y.
Products: Magneto tools. Magneto testing stands. Magnet chargers.
Branch office: 230 Park Ave., New York, N. Y.
Aeronautical personnel: Vincent Bendix, president; H. Hanni, vice-president and general manager; T. Z. Fagan, vice-president in charge of sales; W. J. Spengler, chief engineer.

SCULLY-JONES,
1911 S. Rockwell, Chicago, Ill.
Products: Counterbores (spotfacers and backspotfacers).

SEBASTIAN LATHE COMPANY,
3rd & Philadelphia, Covington, Ky.
Products: Lathes. Tools.

SENECA FALLS MACHINE CO.,
Seneca Falls, N. Y.
Products: Lathes (*Lo-swing* automatic 4" to 8"; high speed; unit lathe; short cut; attachments). Automatic work handling equipment.
Personnel: M. A. Coolidge, president and treasurer; E. R. Smith, vice-president and general manager; V. A. Root, sales manager.

SHARPLES SPECIALTY COMPANY,
Philadelphia, Pa.
Products: Centrifugal oil purifier and reclaimer.

SIDNEY MACHINE CO.,
South Bend, Ind.
Products: Drill presses.

SIEWEK TOOL COMPANY,
Woodward Ave., Detroit, Mich
Products: Standard drill fixtures.

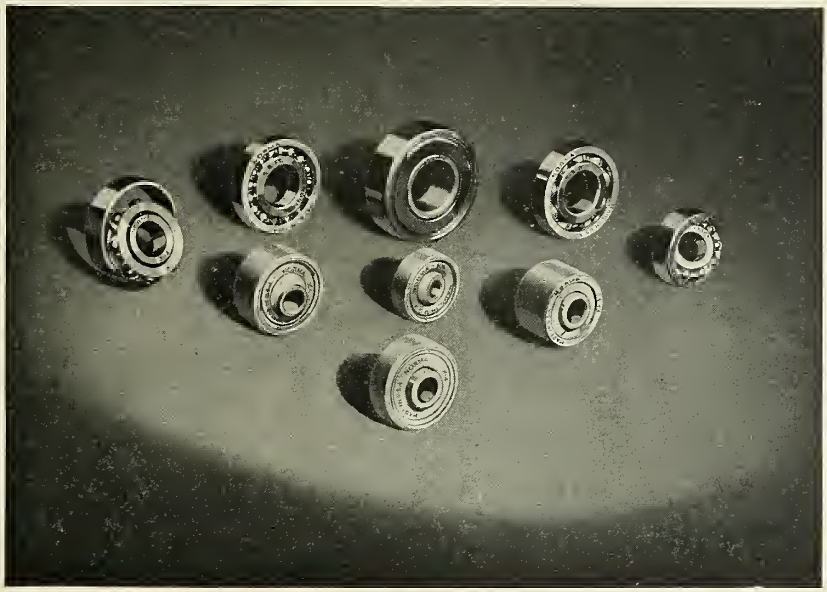
THE SIMMONS MFG. CO.,
Pittsburgh, Pa.
Products: Automatic tapping machines.

SINGER SEWING MACHINE CO.,
Singer Bldg., New York, N Y.
Products: Sewing machines.

SKILSAW, INCORPORTED,
3310 Elston Ave., Chicago, Illinois
Products: Portable electric tools (hand saws; sanders; drills, grinders; hole saws; electric blowers and suction cleaners). Sliding radial arms for saws. Drill stands. Bench drill stands. Bench and pedestal grinders. Combination grinder-buffers. Electrical accessories. Attachments.
Branch offices: 210 E. 40th St., New York, N. Y.; 312 Omar Ave., Los Angeles, Calif.
Personnel: E. W. Ristau, sales manager.

(*Continued on following pages*)

PRECISION BEARINGS



FOR AIRCRAFT CONTROLS

A pioneer experience of a quarter-century is reflected in the manufacture of the PRECISION Aircraft Control Bearings pictured above. During the World War, and in the years since, NORMA-HOFFMANN PRECISION Bearings have been an important factor in aircraft construction, in many vital applications. In practically every history-making flight, NORMA-HOFFMANN Bearings have participated—in planes, engines, controls, instruments or accessories.

The first high-grade ball bearing control pulleys were equipped with these NORMA-HOFFMANN PRECISION Bearings. And NORMA-HOFFMANN engineers, still pioneering, have developed many of the distinctive bearing types now accepted in aviation practice. Today almost every representative manufacturer of aircraft and equipment—including the U. S. Government—is a user of NORMA-HOFFMANN PRECISION Bearings.

The NORMA-HOFFMANN line of 108 distinct series includes—besides control bearings—PRECISION Ball, Roller and Thrust Bearings for practically every aviation requirement. Write for the Catalog, and the booklet "Precision Bearings for Aircraft Controls." Let our engineers work with you.

"NORMA-HOFFMANN"

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.
PRECISION BALL, ROLLER, AND THRUST BEARINGS

Manufacturers of Machinery for Aircraft Production (Continued)

SKINNER CHUCK CO., New Britain, Conn.
Products: Chucks.

J. T. SLOCOMB CO., Providence, R. I.
Products: Counterbores.

H. B. SMITH MACHINE CO., Smithville, N. J.
Products: Woodworking machines. Sanders (double and triple-drum endless bed).
Personnel: E. J. Smith, president; A. H. Howe, vice-president.

THE SMITH & MILLS CO., Cincinnati, Ohio
Products: Shapers.

J. E. SNYDER & SON, Worcester, Mass.
Products: Drill presses.

SOUTH BEND LATHE WORKS, 423 E. Madison St., South Bend, Ind.
Products: Engine lathes.

SOUTHERN IRON & EQUIPMENT CO., Atlanta, Ga.
Products: Wash tanks.

THE SPRINGFIELD MACHINE CO., Springfield, Ohio
Products: Engine lathes.

N. A. STRAND & COMPANY, 5001 N. Lincoln St., Chicago, Ill.
Products: Portable flexible shaft tools (grinders; buffers; polishers; sanders; drills; reamers; rotary files; wire brushes; screw drivers; nut setters; raspers).
Personnel: N. A. Strand; O. V. Strand; C. W. Brakeslee, sales manager.

THE STANDARD ELECTRICAL TOOL CO., Cincinnati, Ohio
Products: Electric drills (portable; radial). Post drill stands. Grinders (tool, post or center; angle plate; internal and external; parallel; vertical angle plate; combination bench and aerial; surface and tool; pedestal; overhang; high speed snagging). Exhauster equipment with air filtering stand. Combination grinding and buffing machines. Adjustable speed buffing and polishing lathes. Portable electric blowers. Hole saws. Attachments.

Branch offices: 125 Church St., New York, N. Y.; 12 Pearl St., Boston, Mass.; 341 Frankfort Ave., N. W., Cleveland, Ohio; 2832 E. Grand Blvd., Detroit, Mich.; 2044 N. 63 St., Philadelphia, Pa.

Personnel: G. H. Feltes, president and treasurer; L. A. Hauck, vice-president and engineer; R. A. Huhn, secretary.

STANDARD TOOL & MFG. CO., Arlington, N. J.
Products: Reamers.

STANLEY ELECTRIC TOOL DIVISION (THE STANLEY WORKS), New Britain, Connecticut
Products: Portable electric drills. Drill stands. Drill chucks and grinder attachments. Electric screw drivers and wrenches. Grinders (portable; bench). Sanders. Electric hammers. Electric safety saws. *Unisheors* (portable; bench; stationary).

Branch offices: 100 Lafayette St., New York, N. Y.; 61 W. Kinzie St., Chicago, Ill.; 13 S. Letitia St., Philadelphia, Pa.; 777 Rockwell Ave., Cleveland, O.; 200 Walnut St., Kansas City, Mo.; 228 W. Commerce St., Detroit, Mich.; American Bank Bldg., Los Angeles, Calif.; Monadnock Bldg., San Francisco, Calif.; 568 First Ave., S., Seattle, Wash.; Coristine Bldg., Montreal, Que., Canada.

Personnel: L. M. Knouse, general manager; C. Powers, superintendent; H. W. Blackman, sales manager.

STARK TOOL CO., Waltham, Mass.
Products: Bench lathes.

STEDFAST & ROULSTON, INC., Boston, Mass.
Products: Hand operated arbor presses.

STERLING PRODUCTS CO., Detroit, Mich.
Products: Air-driven sander (*Speed-Bloc*).
Branch offices: Curtis Building, Detroit, Mich.; 129 W. Third St., Los Angeles, Calif.
Personnel: Dr. S. James Herman, president; R. A. Lundquist, sales manager; F. D. Pease, resident engineer; Ottmar Kehle, consulting engineer and production manager.

STEVENS WALDEN, INC., Worcester, Mass.
Products: Cylinder grinders. Wrenches. Tools and steel boxes.
Personnel: N. W. Bleckley, president and general manager; W. H. Lee, sales manager; H. P. Adams, vice-president and treasurer.

STRONG, CARLISLE & HAMMOND, 1400 W. 3rd St., Cleveland, Ohio
Products: Electric furnaces.

SUMNER IRON WORKS, 2411 First St., S., Everett, Wash.
Products: Swing saws.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill.
Products: Lathes (stub automatic). Milling machines (rigid). Attachments.

SURFACE COMBUSTION CO., Toledo, Ohio
Products: Heat treating furnaces.
Branch office: 60 Wall St., New York, N. Y.

F. J. SWAINE CO., St. Louis, Mo.
Products: Punch presses.

T

THE TAFT PEIRCE MFG CO., Woonsocket, Rhode Island
Products: Production and service tools. Propeller checking plates. Propeller balancing ways. Propeller protractors and adapters (splined; tapered). Production parts. Contract manufacturing.
Branch offices: Woolworth Bldg., New York, N. Y.; 564 W. Randolph St., Chicago, Ill.; 2921 E. Grand Blvd., Detroit, Mich.; 167 E. 11th St., Indianapolis, Ind.
Personnel: F. S. Blackall, Jr., president and treasurer; J. W. Wheeler, Jr., vice-president; W. A. Gordon, III, secretary.

THE TAYLOR & FENN CO., Hartford, Conn.
Products: Presses. Grinders (water; wet tool). Milling machines. Attachments.

TAYLOR INSTRUMENT CO., Rochester, N. Y.
Products: Regulating equipment. Anodic tanks.
Personnel: H. J. Winn, president and treasurer; W. H. Kimmel, secretary; P. R. Jameson, director of sales; sales managers: F. K. Taylor, W. M. Griffith.

THOMSON-GIBB ELECTRIC WELDING CO., Lynn, Massachusetts
Products: Spot welders (light and heavy duty; aluminum; power automatic). Welders (flash; electric resistance; portable gun; seam). Welding presses. *Weld-O-Meters.* Special equipment designed and constructed.
Factories: Lynn, Mass.; Bay City, Mich.
Branch offices: 50 Church St., New York, N. Y.; 10465 Carnegie Ave., Cleveland, O.; 205 W. Wacker Drive, Chicago, Ill.; New Center Bldg., Detroit, Mich.
Personnel: District managers: R. S. Donald (New York); W. O. Little (Cleveland); R. B. Strout (Chicago); A. E. Hackett (Detroit)

THURSTON MFG. CO., Providence, R. I.
Products: *Thurco* milling cutters (angular; helical; involute gear; plain milling; *Woodruff* keyseat). Die milling machines and die sinking attachments. Discs. End mills. Saws. Double end mills and chucks.
Personnel: Howard C. Arnold, sales manager.

TITAN TOOL CO., Erie, Pa.
Products: Stud drivers and setters.

TOLEDO MACHINE & TOOL CO., Toledo, Ohio
Products: Presses (deep gap punch).
Branch offices: 549 W. Washington Blvd., Chicago, Ill.; 258 General Motors Bldg., Detroit, Mich.

TOLEDO SCALE COMPANY, Toledo, Ohio
Products: Gauges and testing apparatus (piston ring and valve spring; connecting rod classifying and standardizing; spring testing). *Aeroplone Propeller Blade Baloncing Auto Gouge.* Industrial scales.
Branch offices: In 181 principal cities in the United States and Canada.
Personnel: M. E. Holmes, manager industrial scale sales.

TORCHWELD EQUIPMENT CO., Chicago, Ill.
Products: Welding equipment.

TOWSLEY MACHINE CO., Cincinnati, Ohio
Products: Cut-off saws and motors.

HAROLD E. TRENT COMPANY, 437 N. 13th St., Philadelphia, Pa.
Products: Enamel baking furnaces.
Personnel: Harold E. Trent, president.

W. W. & C. F. TUCKER, INC., 618 Capitol Ave., Hartford, Conn.
Products: Cutters (shear; rod).
Personnel: H. B. Tucker, president; W. H. Tucker, manager.

U

UNION SPECIAL MACHINE CO., 400 N. Franklin St., Chicago, Ill.
Products: Sewing machines.
Branch offices: 210 Lincoln St., Boston, Mass.; 65 Bleecker St., New York, N. Y.; 32 Albert St., Johnson City, N. Y.; 22 4 St., Waterford, N. Y.; 401 N. Broad St., Philadelphia, Pa.; Temple Bar Bldg., Cincinnati, O.; 1276 W. 3 St., Cleveland, O.; 155 Spring St., Atlanta, Ga.; 1127 Pine St., St. Louis, Mo.; 5014 College Ave., Kansas City, Mo.; F. W. Braun Bldg., Los Angeles, Calif.; 682 Mission St., San Francisco, Calif.
Personnel: A. M. Sheldon, president; Richard MacKay, Jr., vice-president; T. S. Whitsel, general sales manager.

Manufacturers of Machinery for Aircraft Production (Concluded)

UNION TWIST DRILL COMPANY, Althol, Mass.
Products: Form milling cutters. Hobbers (thread-milling; special). Reamers. Core drills.

U. S. DRILL HEAD COMPANY, 1954 W. 6th St., Cincinnati, Ohio
Products: Drill heads (multiple; fixed; adjustable).

U. S. ELECTRICAL TOOL CO., W. Sixth St., Cincinnati, Ohio
Products: Unishears. Grinders (tool; two wheel). Hand milling machines.

U. S. STANDARD MFG. CO., Columbiana, Ohio
Products: Hand milling machines.

U. S. TOOL CO., Detroit, Mich.
Products: Tools (circular form; high speed).

U. S. MACHINERY COMPANY, 136 Liberty St., New York, N. Y.
Products: Drills.

UNIVERSAL BORING MACHINE CO., Hudson, Mass.
Products: Turret lathes.

V

THE V & O PRESS CO., Hudson, N. Y.
Products: Power presses (automatic feeds). Special equipment.

Personnel: Marshall Prentiss, president; Herman Osswald, vice-president; H. F. Zorn, vice-president and sales manager.

VALLEY ELECTRIC COMPANY, S. Kingshighway, St. Louis, Mo.
Products: Grinders (floor). Buffers.

VAN NORMAN MACHINE TOOL COMPANY, Springfield, Mass.
Products: Boring bars. Valve seat grinders and cutters. Valve seat ring tools. Valve refacers. Stud pullers. Automatic piston turning and grinding machines. Milling machines (tool room; production; universal).

Personnel: L. F. Hunderup, sales manager, automotive division; H. G. Hoglund, sales manager, machine tool division.

W

WADELL ENGINEERING CO., Newark, N. J.
Products: Boring fixtures.

WAGNER ELECTRIC CORP., St. Louis, Mo.
Products: Jig saws.

WALKER TURNER CO., INC., Plainfield, N. J.
Products: Lathes (woodworking; gap bed; metal working). Saws (jig; bench; band; tilting arbor). Drill presses. Vertical spindle shapers. Flexible shafts and attachments. Motor grinders, motors and attachments. Transmission equipment and attachments. Benches and machine stands.

Personnel: John L. Hasemann, manager industrial flexible shaft division.

J. D. WALLACE & COMPANY, S. California Ave., Chicago, Ill.
Products: Saws (circular trim; portable band; band; universal saw bench union). Jointers.

THE WARNER & SWASEY CO., Cleveland, Ohio
Products: Lathes (turret 12" to 34"; universal; heavy duty; adjustments). Screw machines.

Branch Offices: Iroquois Bldg., Buffalo, N. Y.; 238 Main St., Cambridge, Mass.; 618-622 Washington Blvd., Chicago, Ill.; 7438 San Fernando Way, Dallas, Tex.; Mutual Home Bldg., Dayton, Ohio; 5928 Second Blvd., Detroit, Mich.; 1118 Santa Fe Avenue, Los Angeles, Calif.; 4908 North Cumberland Blvd., Milwaukee, Wisc.; American Insurance Bldg., Newark, N. J.; 1016 Garfield Ave., Manoa, Upper Darby, Philadelphia, Pa.; 108 Grant Ave., Syracuse, N. Y.

Personnel: P. E. Bliss, president; Chas. J. Stilwell, Clifford S. Stilwell, vice-presidents.

THE WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Connecticut
Products: Rivets, bolts, screws and nut machinery (single and multiple stroke open and solid die). Cutting up machinery (arch geared drawing presses; hydraulic embossing presses; knuckle joining presses; collapsible tube machinery; sub press pillar presses). Presses (open back single action; double action; pillar type single action). Lathes (automatic and semi-automatic; trimmers; hand trimming and knurling; hand feed and semi-automatic; screw cap threaders). Mill machinery. Shears. Rolling mills. Wire roll machinery. Wire drawing machinery. Forming machines.

Branch offices: Bulkley Bldg., Cleveland, Ohio; Chicago Daily News Building, Chicago, Ill.; 740 Vernon Rd., Philadelphia, Pa.

WATSON-STILLMAN COMPANY, 72 West St., New York, N. Y.
Products: Forcing presses.

WEAVER MANUFACTURING CO., Springfield, Ill.
Products: Presses.

WELLMAN, SAVER & MORGAN CO., Cleveland, Ohio
Products: Hydraulic presses.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pennsylvania
Products: Air conditioning apparatus. Gas-electric power sets. Electric melting pots. *Ignitron* spot welding timer. Arc welding sets. Battery charging units. Motor generator sets for anodic treatments.

Factories: East Pittsburgh, Pa.; Attica, N. Y.; Chicopee Falls, Mass.; Cleveland, O.; Derry, Pa.; East Sringfield, Mass.; Emeryville, Calif.; Mansfield, O.; Newark, N. J., Pittsburgh, Pa.; St. Louis, Mo.; Sharon and South Philadelphia, Pa.

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WETMORE REAMER CO., 62-6 27th St., Milwaukee, Wisc.
Products: Reamers.

BAXTER D. WHITNEY & SON, INC., Winchendon, Mass.
Products: Variety rip saws. Spindle shapers. Surfacers.

W. A. WHITNEY MFG. CO., 636 Race St., Rockford, Ill.
Products: Portable and bench lever punches.

Personnel: H. C. Spengler, president.

WICKES BROS., Saginaw, Mich.
Products: Crankshaft turning equipment (heavy duty lathes 20" to 34"; production lathes). Gang saws. Electric blueprinting machinery. Special machinery.

Personnel: C. Bintz, sales manager.

WIEDEMANN MACHINE CO., Sedgley Ave., Philadelphia, Pa.
Products: Turret punches.

Personnel: Theodore Wiedemann, president; T. A. Wiedemann, sales manager; E. J. Rollings, superintendent.

WILSON MECHANICAL INSTRUMENT CO., New York, N Y.
Products: Rockwell hardness testers.

WILSON WELDER & METALS CO., INC., North Bergen, N. J.
Products: Welding machines (electric arc). Electrodes (aluminum rod; stainless steel rod).

Personnel: T. B. Hasler, president; S. S. Stewart, production manager; C. S. Osborne, chief engineer.

WINTER BROS., Detroit, Mich.
Products: Taps.

WORTHINGTON PUMP & MACHINE CORP., Harrison, N. J.
Products: Core wire machines.

HENRY WRIGHT MFG. CO., Hartford, Conn.
Products: Drill presses.

WROUGHT WASHER MFG. CO., Milwaukee, Wisc.
Products: Washers. Stampings. Expansion plugs. Tools and dies. Special machinery. Riveting washers (riveting burrs).

Personnel: F. C. Doepke, president; C. H. Disch, vice-president; W. F. Disch, secretary-treasurer; E. Caldwell, general manager.

Y

YALE & TOWNE MFG. CO. (Philadelphia Division), 4530 Tacony St., Philadelphia, Pa.
Products: Electric chain hoists (spur geared; screw geared; differential; *Pul-Lift*). Hand lift trucks. Skid platforms. *Yale* electric industrial trucks.

YATES-AMERICAN MACHINE CO., Beloit, Wisc.
Products: Saws (combination band, rip and resaw; cut-off; band). Motor-driven hand jointer.
Branch office: Rochester, N. Y.

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Products: Hammers (pedestal).

YOUNG BROS., COMPANY, 6500 Mack Ave., Detroit, Mich.
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A METHOD OF MEASURING TAKE-OFF CHARACTERISTICS

●

V. E. CLARK

● The ability of a land-type airplane to clear an obstacle near the edge of a field is a more important characteristic than the length of take-off run. It is common "hangar" practice to judge the ability of an airplane to get out of a small field safely by *timing* the take-off. In many instances, this method provides a misleading index of true take-off qualities. For example, of two airplanes in the same general class, one with a high pitch propeller but high ratio of wing span to weight may require longer to take off but may clear a higher obstacle than one in which these characteristics are reversed.

In the inexpensive method of measuring altitude after take-off from the ground given here, it is necessary to have the following personnel and equipment: two ground observers; two "altitude rake horses"; pad for data; stake at starting point; and tape or other means for laying out a ground T.

The following additional equipment and personnel are helpful, with importance in the order given: tabulated pad for second ground observer; recording anemometer with stop watch; target on pole at T intersection; third ground observer with flag, stationed at anticipated point of take-off; stop watch for third observer; lime for marking anticipated point of take-off; fourth observer with flag at starting point; and two, three or four hand megaphones.

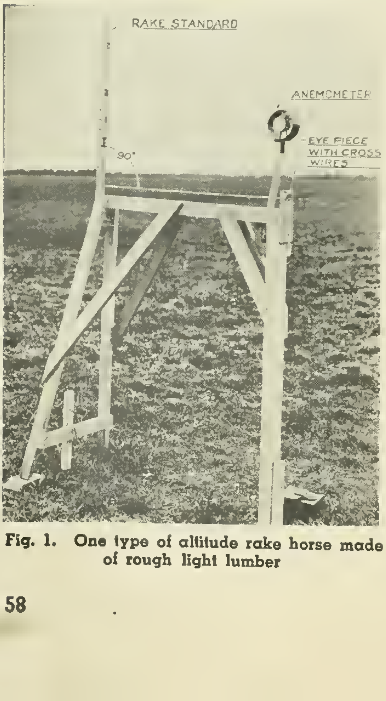


Fig. 1. One type of altitude rake horse made of rough light lumber

The plan is to lay out a T on the ground, the bottom of the leg of the T being the starting point, the leg, (the take-off path) and "altitude rakes" at the ends of the cross bar.

Suppose we decide to measure the altitude 1600 feet from the starting point. Select a spot on the ground near the leeward edge or corner of the field, so located that the take-off path points at some landmark above the horizon, such as a pole, chimney, steeple, or tank.

Drive a stake to serve as starting point marker to the pilot. One of the plane's wheels is to be lined up at the stake for the start of each take-off. Lay out the leg of the T (1600 ft. long). Point exactly at the landmark selected.

While running out this line, leave on the ground a heavy line of distinctive color, (lime) across the leg, at the anticipated (calculated) point of take-off. The distance from starting stake to this mark must be recorded for use by the "run" observer.

At the top of the leg drive a target on a pole, facing the pilot at the starting point. This is on a line between start and landmark and will serve as a range check to the pilot.

From the T intersection, measure, to right and to left, at 90° to the take-off path, a distance of, say, 200 ft., making it 400 ft. between the two stations.

At each station erect an altitude rake, with eye-piece directly over the 200 ft. point.

Figure 1 shows one type of altitude rake horse made of rough light lumber. The eye-hole is about 42 in. above the ground. Nails are driven through the vertical standard, from one side, with equal spacing. The sharp ends of the nails are then dulled. The distance between the cross-wires in the eye-piece and the lowest nail is 30 in. The vertical standard and the line of nails are exactly 90° to the line between the horizontal cross wire in the eye-piece and the lowest nail. As the horse stands sidewise to the wind, the members should be narrow (narrower than shown) to reduce the danger of being blown over.

The eye-piece at each rake is a point of intersection making an angle common to two similar right angle triangles in the same vertical plane. The large triangle has as its hypotenuse the line between cross wires and the lowest point of the airplane as it crosses the plane of the vertical standard, which is also the vertical plane containing the two rakes and the cross bar of the ground T. The rake triangle is the large one to reduced scale. A convenient scale is: 1.5 in. = 10 ft. If the horizontal distance from eye-piece to T intersection is 200 ft., and if the distance from cross wires to bottom nail is 30 in., then vertical spacing of 1.5 inches between nails will represent 10 ft.

For ease in transportation the vertical standard and the eye-piece are screwed in place. The width of base of the horse should be sufficient for stability against a wind but not too great for convenient handling on the running-board of an automobile. If an anemometer is available, it may be mounted as shown, with axis of revolution parallel to take-off path, on the rake located to the right hand side of the take-off path. Its support should also be removable.

Each rake should be mounted with eye-piece directly above the station at the end of the bar of the right angle ground T. Each observer lines his vertical standard on that of the other rake so that the two vertical cross wires in the eye-pieces and the nail edges of the two vertical standards lie in one plane, which should be, as nearly as can be estimated by eye, a vertical plane. By using scraps of shingle or other form of shimming under the legs of the horse, each observer brings the line between horizontal cross-wire and lowest nail to point directly toward the same points of the opposite rake, causing these four to lie in one plane, to which the other plane is perpendicular. It is wise to anchor the rake, after orienting, by stakes and safety wire.

If a third observer is available, he is stationed with a flag at the anticipated point of take-off which has been accurately measured and marked. He should stand, say 40 ft. to one side of the path, on the side more easily visible to the pilot. It is his duty to measure the length of take-off run, and if he has a stop watch, the time for run as well.

If a fourth observer is available, he is stationed at the starting point with a flag, and signals the instant of start by dipping the flag sharply when the wheels start to move. He makes a record of any discrepancy in starting point.

Assuming that the condition of the airplane and power plant has been checked, the weight, or at least the weight of the disposable load, are brought to the desired value and recorded.

The pilot is given his final instructions. He may, for the first three or four take-offs, vary his technique, making records of his method of handling the airplane each time, of the airspeed in final climb, the attitude during run, his judgment as to how long and far he ran on the ground, tail up, beyond the speed at which he felt he could have forced the airplane off, etc. After each of the first few experimental take-offs he turns, lands, and taxies up to the chief observer (at one of the rakes), makes his report and learns whether or not his latest change in technique has given improved results. The pilot should maintain a straight course unitl he has passed the rakes. He should not pull the tail down until his airspeed is eight or ten percent higher than the minimum flying airspeed. In this he must depend upon his judgment.

On the tabulated pad the pilot records (1) number of run; (2) name and model of airplane; (3) engine; (4) propeller; (5) date; (6) hour; (7) r.p.m. standing—full throttle (or at maximum allowable take-off power); (8) r.p.m. (and power) in steep climb; (9) indicated airspeed in steep climb; (10) remarks.

When all observers are at their stations, each signals "ready!", the one near the end of the take-off run raises his flag. The pilot, at the starting point, revs up, throttles back, and when ready, "waggles" his ailerons sharply, after which he watches the flag and starts the run as it is lowered sharply. The run observer starts his stop-watch as his flag strikes the ground,—then watches for the take-off. At take-off he stops his stop watch and runs to the point where the wheels left the ground. He paces (3 ft.) from that point parallel to the path, to the take-off marking line, adds or subtracts, and records (1) number of run; (2) length of take-off run; (3) time in seconds and tenths; and (4) remarks as to handling of airplane.

The order of routine for the rake observer with the anemometer is as follows: Before signalling "ready," the anemometer and stop watch are set back and made ready. When the ailerons are waggled, he throws in the clutch of the anemometer and starts the stop watch simultaneously. He declutches the anemometer and stops the watch just before the plane passes.

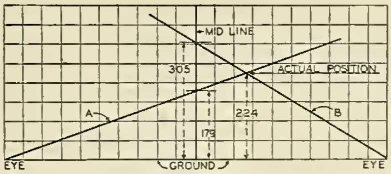


Fig. 2. Graphical method of obtaining correct altitude on co-ordinate paper

Both rake observers kneel as the airplane approaches to cross the vertical plane between them, and note and record the indicated altitude of the lowest point of the airplane as it crosses the nail edge of vertical standard. The anemometer observer, after recording the indicated altitude, records the number of feet of air which have passed through the anemometer and the corresponding time interval. The two observers then interchange indicated altitude figures.

The pilot turns, lands, and repeats. Two or more pilots may be used on the same airplane.

The chief observer, in addition to the data he later receives from the pilot and the run observer, prepares his blank table to record the following: (1) number of run; (2) date; (3) hour; (4) barometer reading; (5) temperature at ground; (6) model of airplane; (7) weight, and/or (8) weight of disposable load; (9) model of engine; (10) propeller; (11) diameter of propeller; (12) name of pilot; (13) feet of wind through anemometer; (14) seconds and tenths for anemometer; (15) indicated altitude from rake A; (16) indicated altitude from rake B; (17) distance of rake line from starting point; (18) distance between rakes; (19) nature of surface of field, with estimate of rolling resistance coefficient, slope, etc.; (20) remarks on handling of airplane.

In addition to corrections for power for non-standard pressure and temperature, and, for great refinement, to aerodynamic forces on airplane and propeller because of non-standard density, the following corrections must be made.

From correction table supplied by the manufacturer of the anemometer a curve should be plotted: (1) true number of feet, vs. (2) indicated number of feet. After calculating for each run, the wind speed during that run, in ft./sec., the speed may be converted to m.p.h.

The scale of rake to actual distance and height is correct only if the airplane passes midway between the two rakes, when, of course, readings A and B should be identical. The correct altitude may be obtained graphically on co-ordinate paper as shown in figure 2. Observer A has read 179 ft.; Observer B, 305 ft., correct altitude $224 + 3.5 = 227.5$ ft. As the eye-pieces are 42 in. above the ground, 3.5 ft. should be added to the indicated values.

If two additional ground observers, and a helper to ride in the airplane, are available, observations of distance to come to a stop after clearing an obstacle of given height may be recorded, while the take-off tests are under way.

The windward extension of the take-off path is used as the landing runway. The pilot's take-off target must be moved to the windward edge of the field.

After each take-off, while the airplane is being turned in the air, a paper bag containing about two pounds of lime well mixed with a similar amount of white sand, attached to the airplane by light fish line (or equivalent) of desired length, is lowered to the full length of the attaching line.

One ground observer, stationed near the basic obstacle reference line to leeward of the take-off starting stake, records the distance of the point where the bag strikes the ground, and bursts, from reference markers previously placed on the ground.

Another ground observer, stationed at the anticipated stopping point, follows the same procedure.

Different identifying numbers are painted on 10 or 12 pieces of rough light-colored wood, three-eighths inch thick or more, and 15 or more inches square. These boards are laid on the ground at measured distances from measured reference points along the path—one set for the obstacle, and another set for the stopping point. The distance between the basic obstacle reference line and the basic stopping reference line is known. The distance (parallel to path) from bag-burst to nearest board is paces (3 ft.) and the distance to basic reference line is recorded. Likewise at the stopping point. The distance to stop beyond the obstacle is obtained by addition and subtraction.

Here again it is essential for the two ground observers to record the number of each run, and it is advisable for them to check each run number by a system of arm waving signals. The anemometer may be used with time interval from that of estimated altitude 150 ft. until just after the wheels touch.

The correction in altitude of the lowest part of the airplane when the bag strikes may best be made by photographing the airplane, with bag fully lowered, while the airplane is gliding, at its usual gliding speed while passing over an obstacle. The flight path should, of course, be directly across (90°) the axis of the camera. From the photograph the difference between the known length of line and the vertical distance between wheels and bag may be measured.

The pilot or his assistant should keep a record of the number of run, the indicated airspeed during glide, indicated airspeed on landing, angle of wing flaps, and observations regarding use of wheel brakes, of power, and other incidents during the landing.

Three of the Bids on the 6-Place Plane Competition

●

DR. ALEXANDER KLEMIN
Guggenheim School of Aeronautics, New York University

● Three companies have released data on their bids for the Department of Commerce's twin-engined six-place plane competition. They are Burnelli Aircraft, Ltd.; Grow, Joy and Co.; and Kinner Airplane and Motor Co., Ltd. An analysis of the manner in which these companies have met the specifications of the Bureau of Air Commerce shows the present trend of small transport design.

Burnelli met the problem with the lowest power, 400 in all, and a maximum estimated speed of 186 m.p.h., Kinner requires 740 horsepower, getting a maximum speed of 211 miles, and Grow, Joy has selected 680 horsepower with an intermediate top speed of 192 m.p.h. All three designs indicate modern practice and the task of making a selection from among them will be difficult.

General specifications called for a twin-engined, six-place cabin monoplane in accordance with *Aeronautics Bulletin* 7-A. The cabin interior was to be at least 5 ft. between floor and ceiling and 5 ft. between side walls at the master section; distance between seat backs, at least 30 in.; seats at least 19 in. inside width; no division between pilot's cockpit and passenger compartment and the seat adjacent to the pilot's seat was to be available for either co-pilot or passenger.

Performance requirements were to be met with fixed equipment as listed, and a useful load (less fuel and oil) consisting of one pilot, 170 lbs.; and payload of 1250 lbs., consisting of 5 passengers (850 lbs.); cargo (200 lbs.); and baggage (200 lbs.). Fuel and oil were to be sufficient for a 500-mile cruising range at any altitude between sea level and 5,000 ft. The performance required was to be obtained when using fuel of not more than 80 octane.

Aerodynamic Features

All three designs are aerodynamically clean and incorporate a number of features which deserve attention as an epitome of modern thought:

Burnelli uses an aileron-type flap; Kinner and Grow, Joy a split flap. In spite of the work which has been done on special ailerons for flaps extending the entire span of the wing, our designers are still dubious as to departures from conventional aileron design. Thus Burnelli uses a flap extending the entire span of the wing, but provides for either simultaneous actuation for lift increase or differential operation for lateral control. Grow, Joy and Kinner retain conventional ailerons, with flaps extending only over the inner portion of the span.

In both the Kinner and Grow, Joy design the undersurface of the wing is unbroken by the fuselage and the flaps extend underneath the fuselage. That portion of the flap which extends under the fuselage should increase the lift to some extent, and the drag considerably.

The center line of the engine is placed on the chord line of the double cambered wings in the Kinner and Grow, Joy designs, a preferred American practice.

Since single engine operation is an integral part of the specifications, controllable pitch propellers are used in the designs and attention has been given to directional control with one engine out of commission. Burnelli uses a Hamilton Standard model with a 7-ft. diameter, and Grow, Joy calls for an 8.5-ft. diameter propeller of similar make. Grow, Joy places reliance on dual fins and rudders located in the engine slipstream, with a trimming tab on the left rudder. In the other designs, fin and rubber are given generous proportion and the lines of thrust of the engines are tilted in toward each other (at an angle of 4° to the plane of symmetry in the Burnelli design; 2° in the Kinner).

Static and dynamic balance of control surfaces, with tabs adjustable in flight and irreversible in action for longitudinal directional and lateral trim may now be taken for granted in our transport design.

All designs place an appreciable portion of fin and rudder below the stabilizer.

Designers fully recognize the advantages of the latest unsymmetrically double cambered airfoils, and taking advantage of their special characteristics place the c.g. forward on the mean aerodynamic chord.

When control surfaces are computed on a basis of wing area percentage, they are found to be quite generous.

Our designers have learned how to combine, in windshield lines, excellent vision with aerodynamic cleanness.

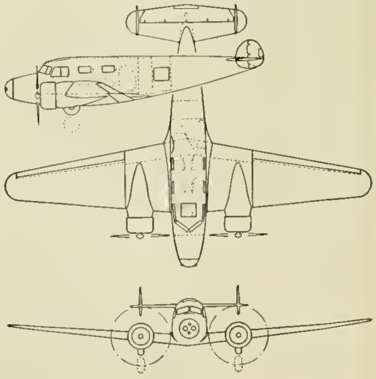
The Burnelli engineers worked out their airfoil fuselage principle so that it applies to a smaller machine. In their design the fuselage being of airfoil form acts as a wing of equivalent area. With the required head room of 5 ft. inside the cabin, normal Burnelli design would have resulted in too large a lifting area. The difficulty was met by using a relatively short chord for the airfoil fuselage, but increasing the thickness ratio to 33% by development of modern NACA wings. Again, to keep down the area, a pronounced taper is employed—which means structural advantage and advantageous blending of wing and fuselage. To provide vision, the cockpit projects beyond the airfoil contour. The aerodynamic design permits a cabin width of 7 ft. 6 in.

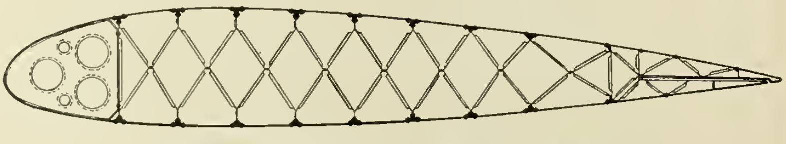
Structural Features

While we have come to believe in recent years that a transport airplane meant an all-metal structure, metal covering of aluminum alloy, apparently not all experienced designers agree with this. Thus, the Kinner design calls for a welded chrome molybdenum steel tube fuselage with fabric covering, and laminated spruce box type spars, plywood covered.

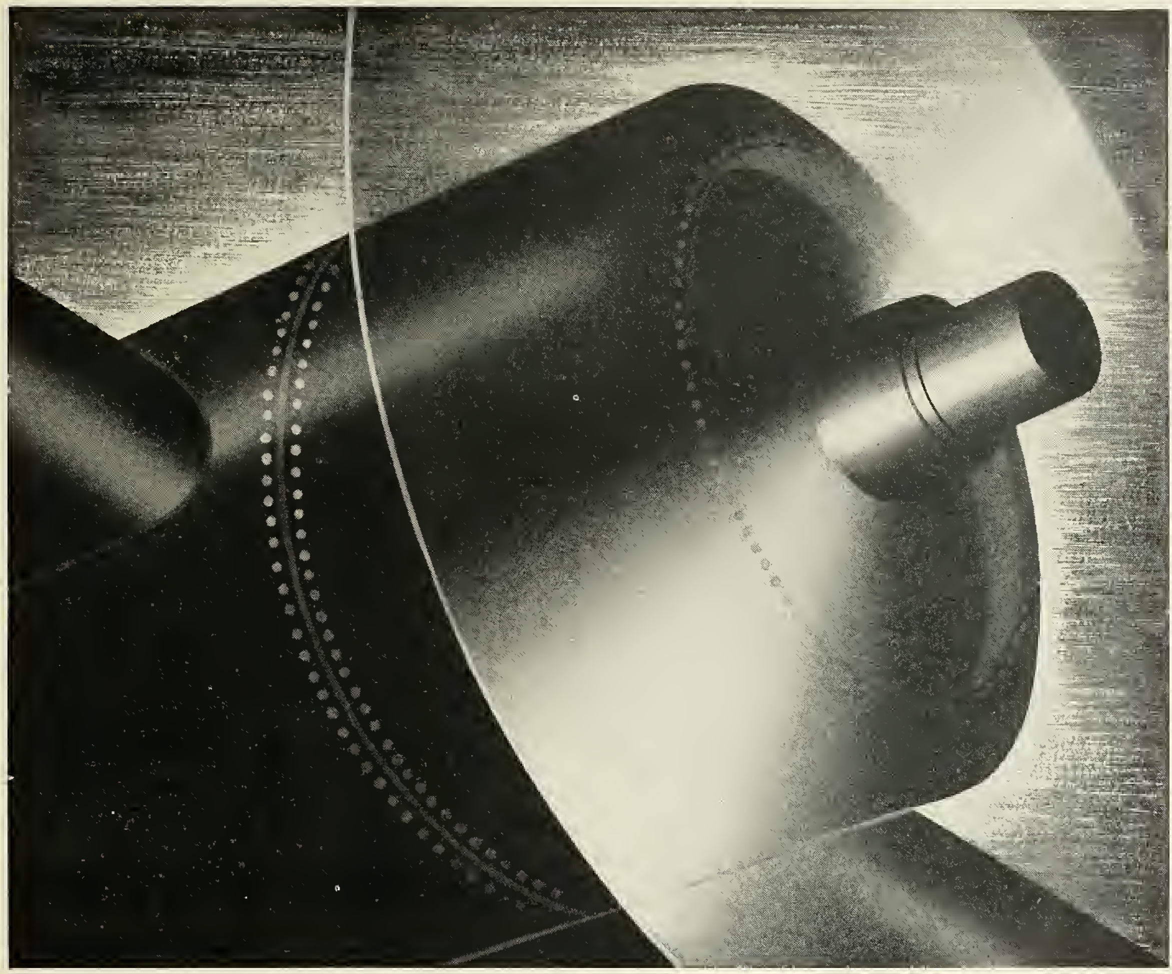
The Grow, Joy structure, on the other hand is of aluminum alloy with the exception of the landing gear and engine mounts which are to be built of carbon or chrome molybdenum steels. The Grow, Joy wing is designed on the Barkley multi-spar stressed skin principle, which calls for a multiplicity of full length spanwise webs of suitably formed and lightened thin sheet metal to which the top and bottom coverings of sheet metal are attached. A number of advantages are claimed for this construction such as: high strength weight ratio; economy in use of materials; light-weight per square foot of wings (2 lbs. for the design in question including aileron and flap); ease of manufacture because the material can be bent on a long brake and fabricated by riveting or spot welding; a multi-spar cellular construction giving strength in bending or torsion; elimination of bulkheads and ribs; location of strongest

(*Continued on following page*)





Rib detail and outlines of the Grow, Joy Transport



MOLY makes better surface-hardening steels

It would be difficult to find a better test of surface-hardened steels than in airplane engines. Cylinders, knuckle pins, propeller shafts, crankshafts and various gears are subjected to particularly severe service. . . Hence the large number of instances in which such parts are made of Molybdenum surface-hardened steels.

There are also many other applications, outside the airplane field, in which the outstanding quality of "Moly" surface-hardened steels to meet the hardest of service requirements has been demonstrated over and over. Whether the process is carburizing or nitriding, the results are the same — and are dependent on the Moly content.

The practical reasons are easily explained. . . Moly increases the speed of penetration and gives a deeper, harder case. The core physical properties are exceptionally good, and there is no susceptibility to temper embrittlement. Distortion on quenching is slight — and uniformly predictable.

Moly cuts costs . . . It reduces the processing time in surface-hardened steels; lowers the rejection percentage. Moly improves steel . . . It makes it stronger, tougher, more resistant to wear, creep, corrosion. Moly creates sales . . . It makes a more serviceable, longer-lasting, more satisfactory product.

A more detailed account of "industry's most modern and versatile alloy" is given in our interesting technical book, "Molybdenum," which is yours for the asking. And, "The Moly Matrix," published periodically, will keep you informed on the latest Moly developments. Shall we put you on the mailing list? Climax Molybdenum Company, 500 Fifth Ave., New York.

MOLY

CLIMAX Mo-lyb-den-um

CUTS COSTS

CREATES SALES

(*Continued from preceding page*)

spars along the area of load concentration; and suitability for cantilever construction by decrease in the web depth, flange width and sheet metal thickness wherever desirable. Sections of the wing adjacent to the fuselage may be blocked and made fuel tight to serve as fuel tanks. Control surfaces are built on the same principle. We are informed that an all-metal, low-wing, single engine, two-place airplane incorporating the Barkley wing construction was built and flown in 1931 and stood up to a factor of twelve under static test. A sample wing is being built for the Bureau of Aeronautics.

The Grow, Joy stressed skin fuselage construction has no fore and aft reinforcing members excepting for a length of about 10 ft. in the region of maximum bending loads where corrugated sheet is laid next to the outer skin and riveted to it. Transverse rings or U-section formers are employed at several points. The bottom of the fuselage is cut away and rests directly upon the upper surface of the wing.

In the Burnelli design, 24 ST is called for throughout excepting in landing gear and engine mount. The wing structure consists of a two-spar design without drag bracing with rib-bulkheads and reinforced upper and lower skin forming a closed box. Webs are of the Wagner tension field type with extruded flanges.

Weight Data

Few weight data were given out by constructors, and only the following analysis of the empty weight of the Burnelli design is available at this time.

Wing Group: outer wings with ailerons, 485 lbs.

Tail Group: stabilizer and elevator, 64 lbs; fin and rudder, 43 lbs.: total, 107 lbs.

Body Group: central wing section, 488 lbs.; engine nacelles, cowling and supports, 104 lbs.; chassis, 223 lbs.: front wheels complete, 80 lbs.; booms, 90 lbs.; total, 985 lbs.

Power Plant: engines (including superchargers), 830 lbs.; engine accessories, 41 lbs.; engine controls, 16 lbs.; propellers and hubs, 210 lbs.; starting system, 52 lbs.; lubricating system, 18 lbs.; fuel system, 123 lbs.; total, 1290 lbs.

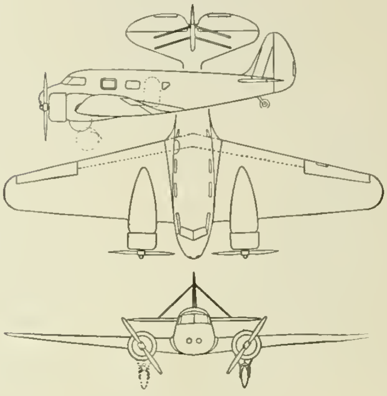
Fixed Equipment: instruments, 47 lbs.; surface controls, 90 lbs.; automatic pilot, 100 lbs.: furnishings, 140 lbs.; electrical equipment, 107 lbs.; miscellaneous equipment, 125 lbs.: total, 609 lbs. Total empty weight, 3476 lbs.

Kinner shows streamline landing wheels, semi-retractable into the engine nacelle. The landing gear is so designed that in the event of complete failure of the operating mechanism it will lower to a locked position by its own weight.

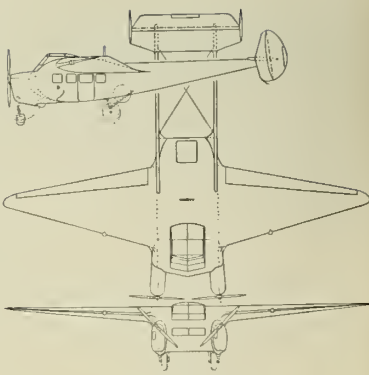
The Grow, Joy may be fully or partially retracted oildraulically and is of the single strut type. Landing may be made with the wheels in any position from fully extended to fully retracted.

In its request for bids the Bureau called for possible modifications of conventional landing gears to the type in which the main wheels are placed aft of the c.g. and one or two wheels are placed ahead of the c.g.

The requirements were: (a) The airplane to take off at a speed not in excess of the speed for maximum rate of climb. (b) The airplane shall be easily controllable on the ground; the wheels forward of the c.g. shall be swivelled or steerable; if the former, steering shall be accomplished by differentially operated brakes on the rear wheels. (c) Service and parking brakes. (d) Airplane shall be capable of being brought to a stop from a speed of 45 m.p.h. in 200 ft. (e) The airplane shall be capable of being satisfactorily landed at any speed from 100 m.p.h. to its minimum, with immediate and full application of brakes. (f) Gear capable of accommodating minimum vertical velocity which can be maintained in a glide without power.



Kinner Transport



Burnelli Transport

With its large central wing fuselage the Burnelli design seems to lend itself particularly well to the embodiment of this type of gear, with complete retraction of all four wheels. On the ground the thrust line is at 2° with the horizontal. Front wheels are mounted on the welded tubular structure of the engine mount and swing back for complete retraction. Rear wheels also swing back and retract completely into the airfoil fuselage in a special wheel well.

The specifications called for fixed equipment of unusual comprehensions including de-icing equipment, radio equipment, lights, fire extinguishers, tools, etc., and

(*Continued on page* 64)

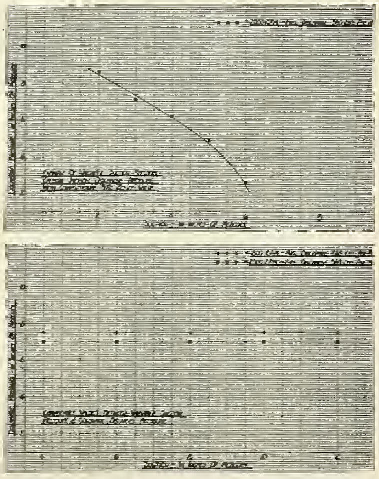
General Data	Burnelli	Grow, Joy	Kinner
Gasoline (gal.)	100	175	184
Oil (gal.)	7	17.5	14
Useful load (lbs.)	2332	2601	2630
Empty weight (lbs.)	3476	4199	5870
Gross weight (lbs.)	5808	6800	8500
Useful load (% gross weight)	40	38.6	31
Wing loading (lbs./sq. ft.)	17.3	19.2	21.4
Power loading, full throttle (lbs./h.p.)	14.5	10.68	11.5
Power loading, cruising (75% power)	19.3	14.16	15.3
Cruising speed at 5000 ft. (m.p.h.)	157(1)	181(2)	190(3)
Maximum rate of climb (ft./min.)	1040	1640	1255
Service ceiling (ft.)	16,200	22,550	22,800
Absolute ceiling (ft.)	18,100	24,000	....
Rate of climb, one engine, gross load (ft./min.)	63.3(4)	590	180
Wingspan	45′ 4″	52′	50′
Overall length	34′ 7″	37′	33′ 9″
Height in level position	9′ 10″	10′ 4″	10′ 7″
Wheel tread	6′ 6″(5)	14′	....
Width inside fuselage	7′ 2″	57″	....
Areas (sq. ft.):			
Wing	335.3	354	396.6
Aileron	47.58	34	24.0
Flaps	47.58	38	....
Fin	12.34	10.5	14.5
Rudder	22.50	15	19.5
Stabilizer	29.8	37	39
Elevators	22.83	27.5	30.5

	Specified Requirements	Burnelli	Grow, Joy	Kinner
Maximum speed (m.p.h.)	175	186	192	211(6)
Landing speed power off (m.p.b.)	65(7)	63.7	64	63
Ceiling, one engine (ft.)	6000(8)	....	13,600	6,300
Distance from start to clear 50 ft. obstacle (ft.)	1500	1469	775	1448
Distance to stop after clearing 50 ft. obstacle (ft.)	1000	843(9)	707	730
Cruising range, 5000 ft. pilot, 5 passengers baggage and and cargo (miles)	500	529	906	745
Cruising range, two pilots, baggage and cargo (miles)	1000	1083	1354	1190

(1) 68% power at 4500 ft.; (2) 75% power; (3) 550 h.p.; (4) at 6000 ft.; (5) average; (6) at 5000 ft.; (7) maximum; (8) minimum; (9) Distance to stop from 45 m.p.h., 200 ft.

Evans NEW TYPE Aircraft FUEL PUMP.. the E-9

For the first time in aviation, a fuel pump has been developed which is reliable, efficient, and fool proof. The new EVANS E-9 maintains correct pressure on the carburetor at all times, regardless of air conditions, temperature, or flying position. A sylphon relief valve assures constant pressure, regardless of the suction head, and the pump is constructed so that a wabble pump can be used in conjunction without affecting the relief valve. Pilots and transportation companies will welcome the EVANS E-9 as a most valuable contribution to flight security.



Charts 1 and 2, above, show the difference in pressure control with the conventional by-pass relief valve and the new sylphon relief valve. The sylphon eliminates relief pressure variation under all suction conditions. This valve permits an instantaneous prime at extremely low engine r.p.m. It can be adjusted at any pressure from 2 to 10 pounds by simple manual adjustment.

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Douglas DC-3 Sleeplane

● The first of the new Douglas sleeper airplanes, now being built for American Airlines, made its initial test flights Dec. 18, at the Santa Monica factory of the Douglas Aircraft Co.

In luxury and completeness of facilities for passenger comfort, the new DST (Douglas Sleeper Transport) or DC-3 is expected to surpass any plane in present operation in the United States. Its gross weight of 24,000 lbs. is 5000 lbs. more than the Douglas DC-2. With a wing span of 95 ft., overall length of 65 ft. and overall height of 16 ft. 4 in., the DC-3 is larger than any other land transport flown on any airline in this country.

In exterior appearance the plane resembles a larger version of the Douglas DC-2 in that it is an all-metal, low-wing monoplane powered with two engines mounted in nacelles set in the wing on either side of the fuselage. From the front, however, the width of the fuselage in comparison to its height is more pronounced and other specifications are considerably enlarged.

Within the cabin this added room is evident. The cabin is 7 ft. 8 in. wide and 6 ft. 6 in. high. Eight sections, four on each side of a broad aisle, comprise the interior of the passenger cabin. Each section includes two seats, each 36 in. wide, facing each other. By night the backs and bases of these seats fold together to form a thick, soft foundation for the mattress for the lower berth. The upper berth and mattress drop into position from the ceiling of the section.

Each berth measures 6 ft. 5 in. in length; lower berths measure 36 in. in width, uppers 32 in. Bottoms of the lower berths are 6 in. above the floor at night and 8 in. during the day, leaving space for storing small hand luggage. The springs and mattress add another 9 in. to the height, holding the sleeping passenger 14 in. above the floor of the cabin. The upper berth is 46.5 in. above the floor and steps are provided to enable passengers to enter this berth with ease.

Cabin windows serve the lower berth. A smaller window, at the head, serves passengers in the upper. Both berths are complete with reading lights, clothes nets, electric call buttons, and baggage racks.

Separate dressing rooms are provided for men and women passengers. These are located at the rear of the cabin and are equipped with running water, mirrors and linens. Toilet facilities are separately located at the rear of each dressing room.

A complete commissary is located at the front of the cabin, directly behind the pilot's cockpit. Provisions will be included for keeping food hot or cold indefinitely without need of thermos equipment. The spaciousness of this compartment will enable the serving of more elaborate meals than are now possible.

Space for baggage and mail is at the extreme aft section of the fuselage and at the forward end of the cabin, directly opposite the commissary.

The cockpit includes every known aid to navigation, including the Sperry gyropilot and the latest type radio equipment. The two Wright Cyclone engines are capable of developing approximately from 850 to 930 h.p. each (930 h.p. available for take-off and 850 h.p. at 4300 ft.) and provide a top speed of 215 m.p.h. at 10,000 ft. Normal cruising speed of 12,000 ft. with 70% available power is 190 m.p.h., with a landing speed of 65. Cruising range is 1,100 miles with 24 passengers or 1,400 miles with 16 passengers.

Power also is sufficient to permit takeoff and climb with one engine and to allow uninterrupted flight with full load on one engine. Both engines are equipped with Hamilton Standard automatic constant-speed propellers.

Wheels retract into the engine nacelles, and a new-type landing gear construction provides more strength and greater smoothness of landing.

Specifications

Wing span	95 feet
Overall length	65 feet
Overall height	16 feet 4 inches
Gross weight	24,000 pounds
Maximum speed (10,000 ft.),	215 miles per hour
Cruising speed (12,000 ft., 75% power)	190 miles per hour
Landing speed	65 miles per hour
Cruising range	1100-1400 miles

6-PLACE PLANE COMPETITION

(*Continued from page 62*)

a complete set of instruments. It also called for ball bearings throughout; adjustable rudder panels; parking brakes; electric hydraulic or mechanical operation of high lift devices and retractable landing gear; adjustable seats; movable panels for visibility in bad weather and provisions to deflect the air so that rain or snow will not enter when the panels are open; shatterproof glass; complete heating and ventilating system; noise level below 75 db. under cruising conditions; lighting; baggage compartment and suitable cargo compartment with ample doors, etc., etc. In fact the Bureau asked for everything in the way of pilot or passenger accommodation, and power plant installation that is to be found on the best of the large twin-engine transports.

Engine Installations

Burnelli design provides for two Menasco B6S engines rated 200 h.p. at 2250 r.p.m. at 4500 ft.; Grow, Joy chose Wright R760 E-2 Whirlwinds rated 320 h.p. at 2100 r.p.m. at 5000 ft.; and Kinner used two Kinner ASC-7 engines rated 370 h.p. at 1900 r.p.m. at sea level.

It is not within the province of the author to check performance estimates submitted or to evaluate comparative merits. While these designs reveal no radical departures (and it is just as well they do not), they indicate that there is an excellent chance of having a moderate sized and moderately powered transport for feeder work and smaller airways.

American Airlines' new Wright-powered Douglas sleeper plane for 16-24 passengers *Wide World photo*

Accuracy of Bubble Sextant Observations

●

Lt. Comm. P. V. H. Weems, U.S.N. (Ret.)

● Instrumental error of a good bubble sextant is less than two nautical miles; but the acceleration error of the bubble might easily be more than 2° of arc, that is, the acceleration error for a single observation might exceed 120 miles. This condition would apparently make it impossible to determine with a bubble sextant the position of a plane in flight close enough for practical purposes.

Fortunately, the law of averages completely changes the picture. If there is no acceleration, the bubble is within 2′ of the true horizon at all times. Furthermore, if the plane is following a steady course, the acceleration errors will *on the average* give observed altitudes with approximately as many plus as minus errors. It remains to be determined how many sights must be averaged to give the desired accuracy, and the writer observed and analyzed the data described below to determine what accuracy might be expected under average conditions.

Flying in an open cockpit plane from Maxwell Field to Langley Field, Va., on a day that was generally clear, with clouds forming toward the end of the flight, with a strong tail wind most of the way, and air that was fairly smooth though there were occasional severe bumps, the author took ten sextant observations. The plane's position was then immediately determined as accurately as possible by air pilotage. Then ten more observations of the sun were taken and the plane's position again determined. This procedure was kept up till the sun set. One hundred and ten observations were taken, and no observation was discarded.

The observed data of sextant altitude, the Greenwich Civil Time, and position were used to compute the true altitude of the sun for the various times. Actually, the altitudes were computed for 20-minute intervals and these altitudes were plotted against Greenwich Civil Time to get a curve of true sextant altitudes. The observed sextant altitudes were then referred to the curve to get the errors.

Errors for single shots were as high as 122 minutes for altitude. Errors for the average of ten shots were as much as 23 minutes. The average of successive errors for the 11 series of observations was 14 minutes of altitude, but as some of these errors were plus and some minus, the average mean error for the 110 sun observations was only (—) 3.1 minutes of altitude.

The low algebraic average error of 3.1 minutes of altitude or 3.1 nautical miles shows how important it is to average numerous observations. It also shows what accuracy may be expected under average conditions. Some navigators recommend throwing out wild shots, but this procedure is questioned because the observer cannot tell which shots are wild. He only thinks he can by the "feel" of the plane, but the proper attitude of the plane is no more determinable by the navigator than by the pilot who admits that he cannot "fly by instinct."

However, to test the theory of eliminating wild shots, the two observations with largest errors in each of the eleven series of ten shots each were discarded. Errors of each of the discarded shots was 40 miles or more, and the average of the individual errors of each series was 13.8 miles as compared with 14 miles without discarding any shots. However, the mean of the average errors with two shots discarded was (—) 4.1 miles as compared with (—) 3.1 miles with no observations discarded. This is brought about by the fact that although the largest errors in each series were discarded, the gain in accuracy by discarding these was more than offset by the loss in accuracy when averaging eight instead of ten sights.

Further study of the discarded shots discloses that eleven were plus errors and eleven minus errors. The plus errors discarded totalled 750 miles or an average of 68 miles, as compared with the minus errors totalling 713 miles giving an average error of minus 65 miles.

The average error of (—) 3.1 for 110

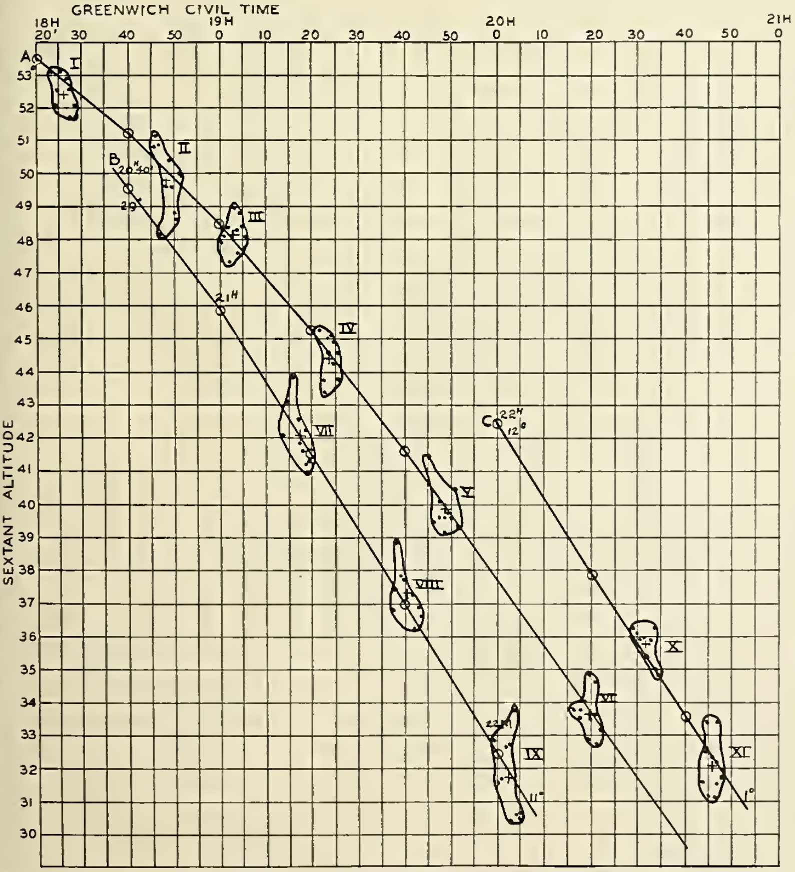


Fig. 1. A series of 110 bubble sextant observations taken in flight plotted against a curve of computed altitudes. The distance from the plotted position of each observation to the curve gives at once the "altitude difference". The algebraic mean of the 110 errors was only (—) 3.1 miles

sights includes errors of solution, in personnel, sextant and watch, and of position as determined by pilotage. Since there is only one combination which is correct, one error might offset another, but probability and chance make it almost certain that bubble errors alone would be less with other errors eliminated. For example, when the altitudes were computed for the positions taken for the maps available, the algebraic mean error was (—) 4.4 miles. Later the positions were taken from Geological Survey maps and the computations reworked with the resulting average mean error of (—) 3.1 miles. This refinement in maps alone eliminated 30% of the error which might otherwise have been attributed to the bubble.

This series of tests, supported by the evidence obtained by thousands of other similar observations, proves that bubble sextant errors can be reduced to an extremely low figure when sufficient observations are averaged. Indications are that it is inadvisable to throw away wild shots because the observer cannot always tell which shots are wild, and the law of averages may be depended upon to reduce errors to practicable limits, say below 5 miles, when sufficient sights are taken and averaged.

Since the operation of adding up a series of observations and dividing is many times a laborious task, a means for avoiding this would be appropriate. Either a suitable averaging device, or an easy solution is needed. The writer has found that precomputed sextant altitudes plotted as a curve offer the most promising means for reducing or avoiding this operation.

Assume that the navigator desires to determine his position in flight by celestial observations. A time about 15 minutes in advance is chosen to start observations. The sextant altitude of the sun or moon (or both) is computed in advance for the position the plane is due to be 15 and 25 minutes later. The altitudes thus computed for an interval of 10 minutes are plotted as a curve of altitudes using as coordinates Greenwich Civil Time and sextant altitudes.

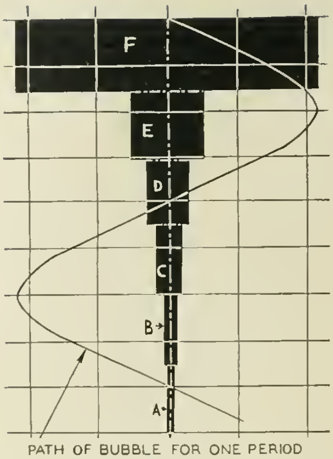


Fig. 2. Graphic analysis of probable bubble acceleration errors based on the data shown in Fig. 1. By the "law of diminishing returns" the accuracy gained by averaging more than about 100 observations would not warrant the extra work. A—Minimum error for unlimited number of shots, three miles. B—For 110 shots, five miles. C—For 50 shots, ten miles. D—For 20 shots, eighteen miles. E—Average error for ten shots, thirty miles. F—Maximum error for a single shot, 128 miles

At the instant for which the first computation is made, observation may be started and as many as desired taken during the 10-minute interval and plotted directly against time and altitude. If the dead-reckoned position of the plane was correct and the observations accurate, the plotted positions of the observations would be along the precomputed altitude curve. If however, the plane should be off its dead-reckoned course, this fact would be shown by the average sextant altitude.

Each observation when referred to the curve immediately gives the "altitude intercept" found by plotting a line of position. If a curve can simultaneously be plotted for the moon and the sun, a series of observations give a definite fix, while if only one body is observed, the same information is obtained as is found by plotting a line of position.

The second-setting watch conforming to Greenwich Civil Time speeds up the operation of plotting observations on the curve. For scheduled flights, the curves may be plotted before taking off. A Bureau of Standards aircraft sextant was used in this test, but any efficient instrument should give similar results as the nature of the bubble is the same for most sextants.

Star altitude curves are recommended for night observation of stars, since they give a quick definite fix with only one subtraction of time as the sole computation. Unfortunately, the rapid motion of the sun and the moon in declination as well as irregular motion in hour angle makes it impracticable to use these bodies with fixed altitude curves similar to star altitude curves.

The importance of celestial navigation for position finding is indicated by the fact that 90% of the first Pan American Airways' trans-Pacific flight was made over clouds which made direct drift observations impossible. Celestial navigation was used by Navigator Fred J. Noonan, with such surprisingly accurate results, that the "China Clipper" reached Honolulu within a short time of its scheduled arrival.

Digest of Technical Articles from Foreign Publications

ELSA GARDNER

Wind-Tunnel Interference

Effect of Limitations of Current on the Characteristics of Wing Models (L'Influsso della limitazione della corrente sulle caratteristiche dei modelli di ali), E. Pistolesi. L'Aerotecnica, Vol. 15, *Nos.* 7-8, *July-August*, 1935, *pp.* 697-734, 15 *figs.*, 65 *equations.*

The solutions given utilize the reflexion method and conformal transformations in determining the influence of limitations of current, such as wind-tunnel walls, on wind-model characteristics, and are the results of research carried out by Prandtl, Glauert, Rosenhead, Poggi, Sasaki and Tomotika, as well as by the author. Some cases are new and illustrate an original method.

The author considers the cases of a current: limited on one side only by an unlimited rigid plane over and under the wing; limited to a half plane, the limiting straight line having free contour; to a half plane with the contour formed by a finite rigid section and by undefined sections remaining free; to a half plane with the contour formed by a finite free section and by undefined sections remaining rigid; and of a current limited by a rigid half straight line and by a free half straight line. He takes up examples of a wing in a two-dimensional channel formed by two parallel rigid and undefined walls, and in one limited by two parallel straight lines both free. He discusses the effects of channels limited by two straight lines, one rigid and the other free, or limited by two portions of rigid walls and their prolongations as a free boundary, as well as the channel with two parallel walls open only at one end and undefined at the other, and that formed by two closed undefined sections with an open intermediate section.

Spinning

Slots and Interceptors in Spins, S. B. Gates, H. B. Irving, R. P. Alston, and A. V. Stephens. (British) Aeronautical Research Committee—Reports and Memoranda No. 1660, *October* 20, 1934 *(published October* 22, 1935) 29 *pp.,* 6 *tables,* 20 *figs. on supplementary plates.*

The effect of automatic slots and interceptors on airplanes in developing spins was investigated in flight, on the National Physical Laboratory spinning balance and in the Royal Aircraft Establishment free-spinning tunnel. It was found that in spinning attitudes each slot lifts and advances its wing tip, the forces depending mainly on the local incidence and speed at the center of the slat. The net effect in a spin depended on the balance between these forces and also on the influence of the added inertia of the slots and on indirect effects depending on the weathercock stability and on the inertia distribution without slots. Bristol Fighter interceptors did not effectively close the outer slot in a spin and when coupled to the ailerons were rendered ineffective by the adverse yawing moment of the ailerons.

Airflow Around a Propeller

Study of the Flow of Air Around a Propeller (Étude de l'écoulement de l'air autour d'une hélice), J. Valensi. Publications Scientifique et Technique du Ministère de l'Air, No. 73, 1935, 248 *pp.*, 186 *figs.*, 67 *tables, Bibliography.*

The exact nature of the vortex outline and its evolution according to the operation of the propeller have been determined experimentally in the research described and measurements and observations made by means of smoke. The absolute trajectories are studied with reference to the plane of propeller rotation and the relative trajectories with reference to the blades. Various propellers and different operating conditions are used and two series of verification given. The marginal vortex is also considered.

Previous work of others on the instantaneous phenomena in the field of the propeller is reviewed with special attention to that of Townend. The relation between the basis of the vortex theory and the author's experimental results is established and a new method given for determining the distribution of circulation around the different sections of the propeller blades.

Heat Convection

On the Problem of Heat Convection with Special Reference to the Theoretical Explanation of Schmidt's Experiments, T. Sasaki. Tokio Imperial University—Aeronautical Research Institute, No. 127, *Vol.* 10, *No.* 9, *August*, 1935, *pp.* 265-279, 5 *figs.* 2 *tables.*

Theoretical calculations are given to explain the results obtained by Schmidt in his experiments with a current of cold fluid encountering a warm fluid, and buoying it up. It was found that beneath the warmer fluid the colder rushed forward forming a sheet the farthest end of which was not only wedge shaped but also swollen up like a head. It was also evident by observation of the motion of the particles that a vortex was set up in this part of the fluid and mixing of the cold and warm fluid took place.

High-Speed Wind Tunnels

High-Speed Wind Tunnels (Gallerie aerodynamiche per alto velocità), L. Crocco. L'Aerotecnica, Vol. 15, *Nos.* 7-8, *July-August*, 1935, *pp.* 735-778, 30 *figs.*

Continuing his investigation of high-speed wind tunnels from the March issue of the magazine, the author gives calculations based on the assumption of suitable values for the efficiency of the compressor and blower, discussing the latter in detail on the basis of theoretical and experimental data. He checks the results by the application of his own formulas to data obtained with the British high-speed induced wind tunnel at the National Physical Laboratory and applies his formulas to some interesting cases, calculating the corresponding energy ratios and required power. The results given show the net superiority of the direct wind tunnel over the induced in regard to energy ratios and required power, limiting the use of the induced tunnel to those cases in which other considerations are of more importance.

Wind-Tunnel Interference

The Effect of Wind-Tunnel Wall Interference on the Pitching Moments of Large Models in the Duplex Tunnel, W. L. Cowley and G. A. McMillan. (British) Aeronautical Research Committee—Reports and Memoranda No. 1639, *November* 5, 1934 *(Published August* 13, 1935*),* 9 *pp.*, 4 *figs. on supplementary plates.*

Wind-tunnel correction was investigated for the pitching moment on a model aircraft which is large compared with the size of the tunnel. Attention was given to a Duplex tunnel in which the breadth was twice the height. The effect on the pitching-moment tunnel correction of the span of the model, finite length of the tail, and the load grading along the wings was also analyzed.

Turbulence Measurements

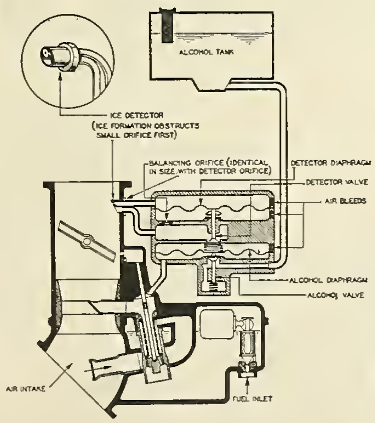
Comparative Measurements of Turbulence by Three Methods. (British) Aeronautical Research Committee—Reports and Memoranda No. 1651, *October* 24, 1934 *(published October* 22, 1935*),* 17 *pp.*, 8 *figs. on supplementary sheets,* 5 *tables.*

The hot-wire, ultramicroscope and spark methods employed by the National Physical Laboratory for measuring turbulence are compared, the experiments having been made in an air stream in which different degrees of turbulence were obtained by passing the stream through a contraction. The ratio of root mean square values to maximum values obtained by the hot-wire and spark methods were in good agreement, as also were the ratios of turbulence in the inlet and outlet by all three methods, but the absolute values obtained by the three methods were in less satisfactory agreement.

Airplane Cooling Tests

Cooling Problems, with Particular Reference to the Work of the 24 ft. R.A.E. Tunnel, G. P. Douglas. Royal Aeronautical Society—Preprint for Meeting, November 18, 1935, 18 *pp.*, 11 *figs.*

After describing the leading features and operation of the new 24-ft. wind tunnel at the Royal Aircraft Establishment, the author discusses the cooling tests undertaken on full-scale airplanes to determine the magnitude of the engine and cooling drag of existing engines and how this could be reduced. He indicates the lines on which to proceed to keep down cooling losses as the flight speeds increase and the dangers of serious entry losses to be avoided. When oil coolers used were of the internal type, and were provided with a duct so that the cooling air discharged at the trailing edge, the drag was found to be too small to be measured. While baffles could be employed to reduce cooling losses, the Gauntlet results suggested that efficient cooling at low power cost could be obtained without that complication. The author believes that the increase of speed provides a convenient adiabatic compression and that there is a possibility of using this heat cycle so that the cooling will add to the propulsive instead of to the drag force.



Normally the detector orifice is clear, pressures on both sides of detector diaphragm are equal and detector valve is closed.
When ice obstructs small orifice pressure rises in the chamber above detector diaphragm and detector valve opens.

Normally the alcohol valve is held closed by spring. When detector valve is opened, suction acts on alcohol diaphragm and allows alcohol valve to open. Then alcohol is introduced with the fuel, ice dispersed, pressure balance restored and alcohol valve closed (normal condition).

DIAGRAMMATIC ARRANGEMENT OF AUTOMATIC DE-ICING UNIT FOR CARBURETTORS

Diagram accompanying article in a recent British Air Ministry Report and Memoranda

Hydrodynamics

The Hydrodynamics of the Rotating Cylinder (L'hydrodynamique du cylindre tournant), M. Luntz and P. Schwarz. Publications Scientifique et Techniques du Ministère de l'Air, No. 71, 1935, 37 *pp.*, 40 *figs.*, 16 *supplementary plates.*

Phenomena connected with the rotation of a cylinder in an indefinite liquid surface are studied with particular reference to the vortex outline which the rotation is likely to create. The authors compare the theories of Bénard, Karman, Rayleigh and Terada with their experimental results, and describe the apparatus developed and results obtained in a qualitative study of the different motions provoked by the rotation of a cylinder. They conclude with numerical data on a study of the field of speeds in a motion without precession, and on the variation of the radius of the centripetal vortex tore in functions of the depth of the liquid, the radius of the cylinder and the constant viscosity of the liquid, discussing the phenomena of precession.

Television for Airplanes

Television and Its Possible Application to Aeronautics (La televisione e sue possibili applicazioni ai fini aeronautici), A. Crotti. Rivista Aeronautica, Vol. 11, *No.* 11, *November,* 1935, *pp.* 183-193, 3 *figs.*

The problem of the radio-electric transmission of images and how the process of television is developed are discussed with reference to its possible applications to the airplane. The author examines the gauge of waves which it is necessary to adopt in order to avoid the eccentricities in propagation and describes the apparatus for sending and receiving images. He concludes with a discussion of possible uses of television in military aeronautics.

Seaplane Wing Setting

The Effect of Wing Setting on the Water Performance of Seaplanes, W. G. A. Perring. (British) Aeronautical Research Committee—Reports and Memoranda No. 1656, August 15, 1934 (published October 17, 1935), 8 pp., 3 figs.

Expressions for the combined air and water drag of a seaplane have been written to determine the optimum setting of the wings relative to the hull, the theoretical results being checked by take-off calculations for a typical flying boat based on results of experiments. The optimum setting was found to be dependent upon the running angle of the hull and the aspect ratio of the wing structure.

Parachutes

Parachutes for the Flying Personnel (Les parachutes due personnel navigant), A. Paricaud. L'Aéronautique, Vol. 17, No. 196, September, 1935, pp. 230-238, 16 figs.

Improvements attained in parachutes with regard to landing speed, time of opening and force exerted on opening are discussed and their adaptation to the user and the present speed of airplanes is pointed out. The author considers the effect of porosity of the material and the use of shock absorbers to reduce the opening force. He describes the construction of the Aérazur, A.L.O.Z. 100, Gravereaux, Vinay, Irvin, and Salvator parachutes and gives the results of tests on them which were made by the Service Technique et Aéronautique.

Magnesium Alloy

The Transpositions of Construction Materials. Applications to the Substitution of Magnesium and Alloy Steels or New Materials (Les transpositions de matériaux en construction. Applications à la mise en oeuvre du magnésium et des aciers alliages ou matériaux nouveaux), H. Portier. Publications Scientifique et Techniques du Ministère de l'Air, No. 72, 1935, 153 pp., 73 figs.

The substitution of one material for another in airplane construction is discussed with special reference to the substitution of magnesium alloys for metals now in use. The investigation was undertaken to obtain either a lighter construction for the same degree of safety, or a greater degree of safety for the same weight, and takes into consideration both normal conditions of loading and overloads. The results are given in the form of nomographs for quick use, all experimental corrections having been made in the dimensions. The author considers the part in its place, the entire section, the form of which governs the moments of inertia, and the local thickness at each point of the section. He defines the true safety ratio of a part which is weaker than the three independent factors of safety relating to the static equilibrium, elastic stability, and local rigidity, giving the law of thickness governed by the last. He limits his research to the study of complex flexure and of buckling and selects among the properties of materials those of elastic limit, modulus of elasticity in flexure, and density.

Cold-Pressing Materials

A Research into Tests for Materials Used in Cold Pressing Operations, with Special Reference to the Fluid-Pressure Cupping Test, H. J. Gough and G. A. Hankins. Cold Pressing and Drawing—the Metallurgical Aspect, C. H. Desch. New Researches on the Drawing of Cylindrical Shells, G. Sachs. Royal Aeronautical Society Journal, Vol. 39, No. 299, November, 1935, pp. 1047-1091 and (discussion) 1092-1122, 47 figs., Bibliography.

Some of the mechanical tests which are often employed for sheet metal are described in the first paper of the symposium, with details of the Jovignot fluid-pressure cupping test which was investigated and developed at the National Physical Laboratory. The Erichsen, Avery, Guillery and K. W. I. cupping tests are discussed and the various measures of ductility afforded by these tests compared with that obtained with the Jovignot test. The paper dealing with the metallurgical problems in finding materials suitable for cold pressing is devoted mainly to the carbon steels although stainless steel and aluminum are referred to. Production of a suitable grain size and texture and the preservation of an unoxidized surface during annealing are taken up. The third paper covers deep drawing and ironing, tool form and drawing capacity, blank holder and drawing capacity, and the testing of sheet ductility.

De-Oxidized Aircraft Tubing

● The interest being manifested in the bright-finish aircraft tubing produced for the past year or so by Summerill Tubing Co. warrants discussion as to how this type of tubing was developed and why it is an improvement over the previous tubing used in aircraft construction.

Going back into aircraft history, it might be noted that, after numerous experiments with various available materials, Government aircraft engineers adopted seamless tubing as best suited to aircraft construction. Numerous comparative tests finally resulted in the selection of a modified standard SAE chrome-molybdenum analysis, identified as WD-4130-X.

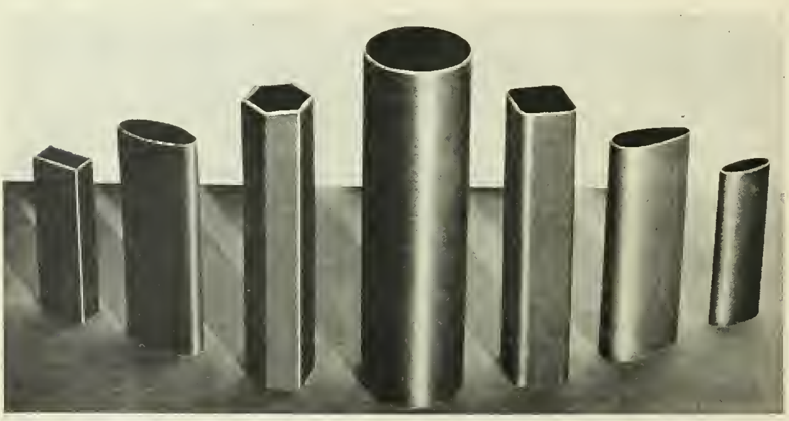
Tubing was selected because of its high weight strength ratio and because of the large available productive capacity of competitive interests in widely scattered localities, considerations of prime importance in time of national emergency.

The chrome-molybdenum analysis selected has many properties peculiarly ideal to aircraft application. It has mild air hardening properties which permit the development of high and uniform physical properties by normalizing (heating to high temperature with air quench treatment following the final cold working operation). This normalizing treatment, however, in open furnaces resulted in a heavy deposit of scale of oxide, which for years was accepted as one of the necessary evils about which nothing could be done.

At a joint meeting of tube manufacturers and Army and Navy aircraft engineers at Wright Field in 1932, specification 57-180-2C was revised to demand a scale-free normalized tube. The response of the manufacturers was almost immediate, and scaled aircraft tubing became obsolete almost overnight. While this smooth finish was a great improvement, some engineers at Summerill thought further development and improvement could be obtained.

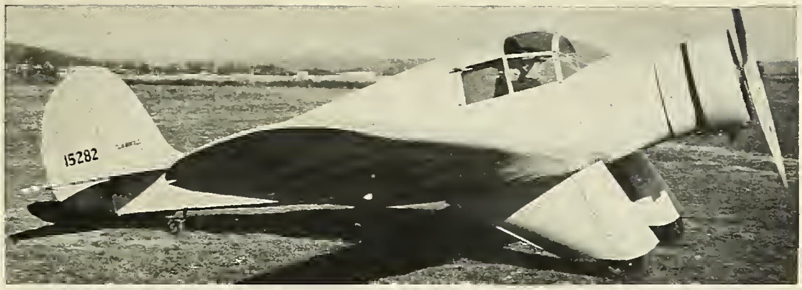
While the new finish was free from scale, it was still characterized by a coat of dark oxide. Many manufacturers removed this coating by sand blasting, a procedure which permits closer surface inspection and reduces oxide contamination at the weld.

After many experiments, Summerill produced oxide-free tubing. Experience proved that heating for the normalizing treatment in a controlled atmosphere reduced the thickness of the oxide film to a minimum and a subsequent process developed in the Summerill plant by empirical methods was used to remove this film. The result is an oxide-free tubing, permitting easier detection of imperfections by inspectors and reducing oxide contamination of the weld metal of assemblies.



Typical sections of oxide-free Summerill tubing for aircraft

Aeronca's New Low-wing Cabin



● Produced in two models known as the LA and LB, the two-place full cantilever low-wing Aeroncas for private and commercial operators are powered with the LeBlond "70" and "85" engines, respectively. Both models are identical in constructional details, only the performance varying according to the power plant used.

Fabric-covered chrome-molybdenum steel tubing is utilized for fuselage construction, the rear section being faired to the fin. The cabin is roomy and light, visibility being enhanced by the fact that pilot and passenger sit side-by-side over the front spar of the wing. Colored pyralin used in the overhead window acts as a shade and also allows unobstructed upward visibility. The interior of the cabin is upholstered, and *Seapac* soundproof insulation is used at the firewall to reduce cabin noise. A baggage compartment is directly aft of the seat and is large enough to hold several large Gladstone bags.

A crackle black finish has been chosen for the instrument panel which is mounted in such a position as to throw light on all instruments. It is also made large enough to accommodate instruments other than those supplied which the owner may wish to add. The throttle control is at the lower center of the instrument panel with the choke and mixture controls at its right and left.

A door on the right side offers access to the cabin and small windows on each side can be opened for ventilation.

There are dual rudder pedals and control sticks, each having independent control cable systems to the rudder and elevators. Rudder pedals are adjustable and act as a brake when the hand lever at the right of the pilot is pulled back. This system eliminates the necessity for an additional set of brake pedals in the cabin. The hand brake also acts as a parking brake.

An air brake (extra equipment) is operated by a lever adjacent to the hand wheel brake. This flap is mounted below the front spar, under and extending the full width of the fuselage. An adjustable trimming tab control is on the front spar within reach of the pilot or passenger, and is used in place of an adjustable stabilizer to provide the necessary longitudinal trim.

The wing is constructed in three sections, using an NACA 2218 airfoil section at the root, tapering to an NACA 2209 section at the tips. A dihedral of 4° is maintained along the top of the wing.

The 18-ft. center section is of spruce box spar and truss type rib construction. Double drag wire trussing is used throughout. The leading edge is of dural, and the entire wing is fabric-covered. There is a 19-gal. fuel tank in the wing center section at the right of the fuselage. Attachment of the fuselage to the center section of the wing is by clamps.

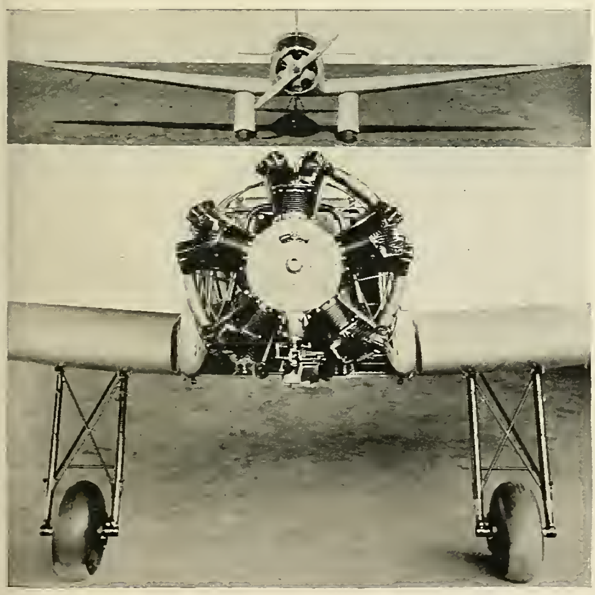
Wing tip sections include the ailerons and are of solid spruce spar and truss rib construction with double drag wire trussing and *Flightex* fabric covering. Tip sections are attached to the center section by four tapered bolts.

Ailerons and Tail Surfaces

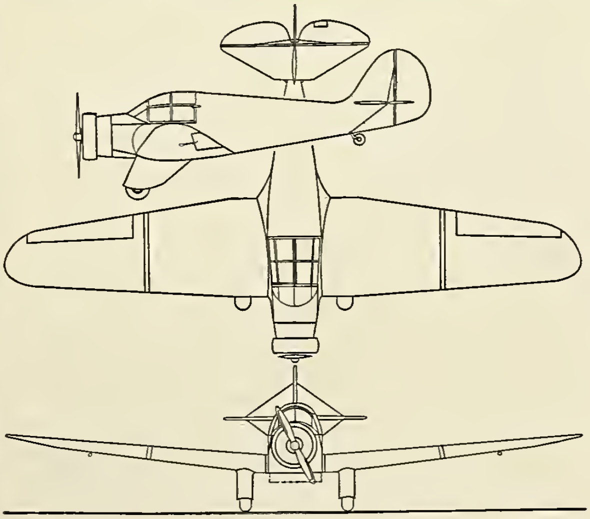
Ailerons are built-up dural channel sections riveted together, and fabric-covered. They are attached to the rear spar of the wing by three piano hinges and are static balanced by a weight extending forward of the control arm on the aileron.

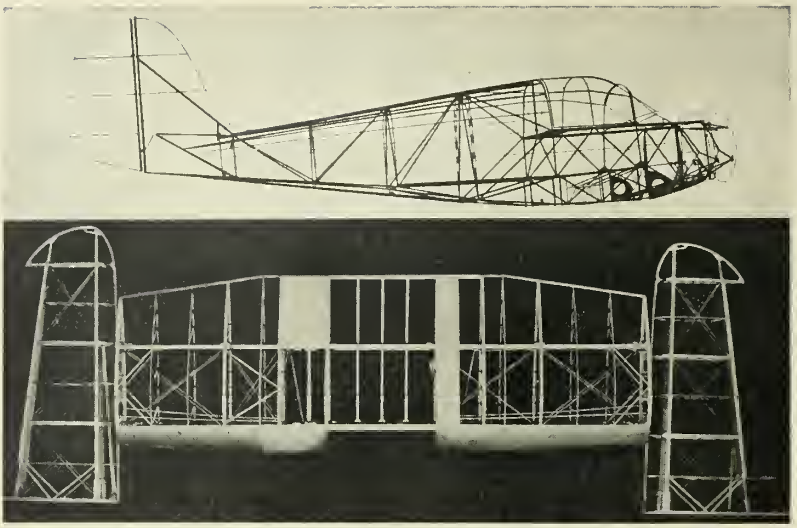
Tail surfaces are of welded steel tube construction, fabric-covered and wire-braced. The fin is integral with the fuselage frame. Stabilizers are interchangeable with one another, and are fixed rigidly to the fuselage as a dural trimming tab is used on the left elevator for longitudinal balance. This tab is operated from the cabin by a cable control.

The fixed full cantilever landing gear consists of twin Aeronca oleos with a



Direct front view and engine and landing gear installation. Outlines of the Lambert-powered low-wing Aeronca





Fuselage framework, and center section and outer panels of Aeronca wing

maximum travel of 4 in. at each wheel. Either 7.00 × 5 or 18 × 8 airwheels, with brakes may be used. Brakes are operated through a Bowden wire control to the cabin. The entire landing gear is enclosed in streamlined fairings.

An 8-in. streamline tail wheel of the full swiveling type is used. Shock is taken through a spring and oscillation is damped out by a rubber dampener.

The engine is mounted in rubber and is enclosed in a speed ring. Tankage is provided for a maximum of 28 gal. of fuel and 2 gal. of oil.

Standard Equipment

Standard equipment on both models consists of wheel brakes, tail wheel, wheel pants, seat cushions, fire extinguisher, air-speed indicator, compass, log books, first-aid kit, and wiring for navigation lights. Special equipment available for these models includes navigation lights, retractable landing lights, flares, air brakes and cabin heater.

Both models will be mounted on Edo floats and marketed as seaplanes in the near future.

Specifications

Wing span	36 feet
Overall length	22 feet 6 inches
Overall height	7 feet
Wing area	150 square feet
Wing loading	11.2 lbs./sq. ft.
Fuel capacity	28 gallons
Oil capacity	2 gallons

Weights and Performances

	LA	LB
Engine (LeBlond)	"70"	"85"
Empty weight (lbs.)	1021	1011
Useful load (lbs.)	659	669
Payload (lbs.)	321	331
Gross weight (lbs.)	1680	1680
Power loading (lbs./h.p.)	24	19.8
Maximum speed at sea level (m.p.h.)	115	120
Cruising speed (m.p.h.)	100	105
Landing speed (full load; m.p.h.)	48	48
Rate of climb (ft./min.)	600	750
Service ceiling (ft.)	13,000	16,000
Cruising range (miles)	500	500

Recent Aeronautical Patents

●

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Airfoil and method of making. Earl J. W. Ragsdale, Norristown, Pa., assignor to Edward G. Budd Mfg. Co. (2,019,272)

Parachute. Samuel H. Knight, Lancaster, Pa., assignor to Follmer, Clogg & Co. (2,019,437)

Aircraft braking wheel structure, Claude Sauzedde, Detroit, Mich., assignor to Detroit Hydrostatic Brake Corp. (2,019,508)

Sky writing apparatus. Wendell H. Brookley, Washington, D. C. (2,019,652)

Course calculating instrument. Bradley Jones, Cincinnati, Ohio. (2,019,708)

Combination lifting and forward propulsion device for use on air and water vehicles. Otto K. Quast, Spokane, Wash. (2,019,726)

Airfoil. Clifford C. Jones, Washington, D. C.)2,019,819)

Flying machine. Emil G. Johanson, Chicago, Ill. (2,019,909)

Propellers. Clinton H. Havill, East Orange, N. J., assignor to Eclipse Aviation Corp. (2,019,965 and 2,019,966)

Rotor screw suitable for helicopters. John H. Bradbury, Brisbane, Queensland, Australia. (2,020,235)

Variable-pitch propeller. Earl L. Coates, Pittsburgh, Pa. (2,020,239)

Method and apparatus for launching seaplanes. George F. Myers, New York, N. Y. (2,020,324)

Variable-pitch propeller. Clarence MacCallum, Port Washington, N. Y. (2,020,366)

Aircraft engine. Oscar L. Snyder, Marysville, Mich., assignor to Continental Motors Corp., Detroit, Mich. (2,020,621)

Parachute pack and chair. Stanley Switik, Trenton, N. J. (2,020,746)

Construction of the trailing edges of airplane-wings. Harry N. Atwood, South Lyndeboro, N. H. (2,020,759)

Aircraft appliance. Cornwallis D. Ellingston, Great Falls, Mont. (2,020,772)

Aircraft engine and gun assembly. Marc Birkigt, Bois Colombes, France. (2,020,872)

Compensated compass, especially for aerial vehicles. Guy O. Robert, Paris, France. (2,020,905)

Control device and automatic pilot. Sergei D. Mitereff, Petersburgh, Va. (2,015,861 and 2,015,862)

Method and apparatus for plotting maps from aerial photographs. Sidney H. Birdseye, Washington, D. C. (2,021,140)

Indicator for aircraft. Donald P. Beamer, Uniontown, Pa. (2,021,250)

Retractable landing gear and operating means. Charles E. Hathorn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,021,307)

Folding wing airplane. Robert R. Osborn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,021,324)

Wheel fairing. George A. Page, Jr., Freeport, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,021,325)

Retractable landing gear. Samuel T. Payne, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,021,326)

Flying machine. Edward Warner, Jersey City, N. J. (2,021,438)

Retractable landing gear Edward C. Wells, Seattle, Wash., assignor to Boeing Aircraft Co. (2,021,439)

Aircraft. Ralph H. Upson, Ann Arbor, Mich. (2,021,470)

Folding propeller. Claude Dornier, Friedrichshafen, Germany. (2,021,481)

Airport boundary light. Thomas W. Rolph, Newark, Ohio, assignor to Holophane Co., New York, N. Y. (2,021,611)

Aircraft. Alvin T. Gilpin, Liberty, Ky. (2,021,627)

Aircraft landing gear, and amphibion aircraft pontoon. Alexander P. de Seversky, New York, N. Y., assignor to Seversky Aircraft Corp. (2,021,876 and 2,023,312)

Device for indicating the position of ships. Arthur P. Davis, Brooklyn, N. Y. (2,022,275)

Flying machine. George F. Myers, New York, N. Y. (2,022,476)

Pitch change control. Clarence K. Greene, Los Angeles, Calif. (2,022,499)

Propeller. Oskar F. A. E. Grumpelt, Hamburg, Germany. (2,022,562)

Speed transmission. Robert E. Grey, Bernice L. Boynton, and Davidson R. Kirkpatrick, Langfield, Va. (2,022,663)

Airfoil. Charles H. Grant, New Rochelle, N. Y. (2,022,806)

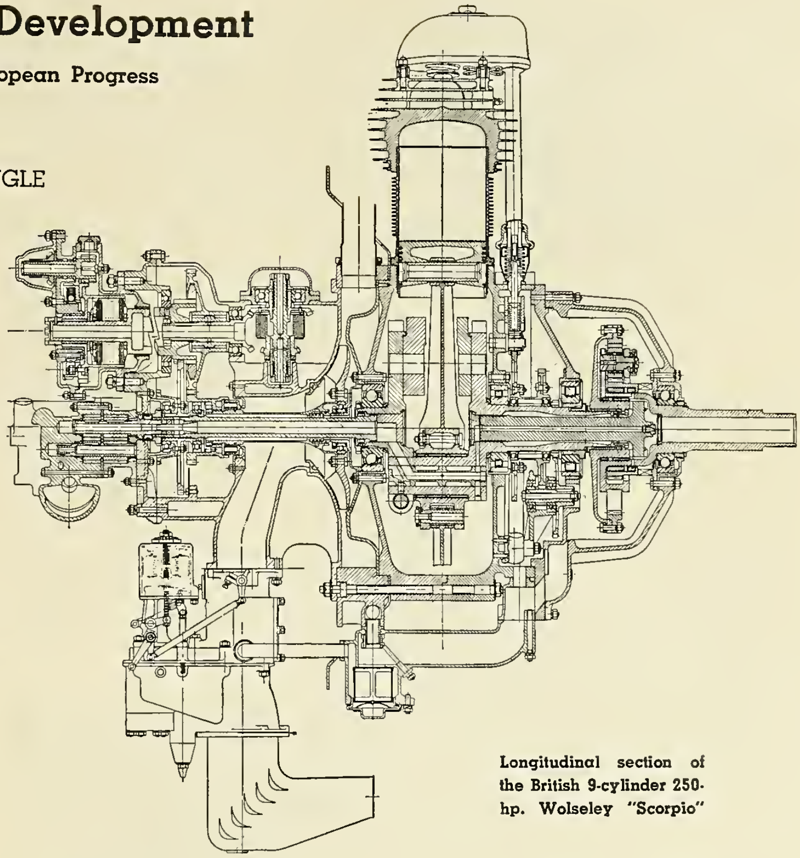
Autocopter aircraft. John W. Smith, Overbrook Manor, Pa. (2,023,105)

Aircraft Engine Development

A Review of Recent European Progress

●

GLENN D. ANGLE



Longitudinal section of the British 9-cylinder 250-hp. Wolseley "Scorpio"

● While the annual inventory may be considered just a custom in some circles, it often brings to light important facts which are of a vital nature. Thus, as we enter a new year—with its prospects for further advances in the development of aviation, it might be advisable to take a quasi-inventory, particularly with a view toward comparing domestic progress in engine development with that reported from Europe. Surely, some good will come from such a survey, since it should illustrate clearly those phases of engine development in which we are now lagging by reason of the fact that we give them little or no attention.

Evidence for the need of an analysis of the aircraft engine situation at this time is contained in the records. For the past three and one-half years, not a single strictly new design has received an Approved Type Certificate from the Department of Commerce. Each of the more than sixty models which were approved was derived from a previously approved model, including also the two-row fourteen-cylinder radial engines, the only new types to make an appearance during the above-mentioned period.

Production of new designs is not necessarily a measure of progress; in fact, in many instances, it may represent nothing more than a waste of time and money. For this reason, we must not construe this evident lack of new designs as an indication of inferiority on the part of American engineers in engine development. As a matter of fact, the leading American designs generally outstrip those originating in Europe in several respects, particularly performance and reliability, as well as the possibility of being produced in larger quantities whenever the occasion demands.

The concentrated development upon a limited number of designs, especially those for military and airline service, together with the experience obtained by their daily operation under all flying conditions, is probably as much responsible for this high state of refinement as the skill or ingenuity of the designers. But it is most significant that the leading American designs are largely confined to engines of a few types, as well as relatively narrow ranges of power.

What, then, are the conditions which offer a logical explanation for this situation as compared to the introduction of many different engine types, extending over the entire power range, by European aircraft engine manufacturers? Before attempting to find an answer, we should review briefly some of the new aircraft engines which have appeared abroad during the past few months and confront ourselves with evidence of the contrast in conditions outlined above.

Let us start with the small engines—those rated at less than 50 hp. In this class, there is renewed interest in the two-stroke cycle of operation.

In England, the Scott Motor Cycle Co. has introduced an air-cooled inverted two-cylinder in-line engine with a 2:1 propeller reduction gear, the rated output being 16 hp. at 2800 r.p.m. One of these days, C. F. Caunter may bring out an engine commanding special attention, because he has devoted considerable time in study and research of the two-cycle principle.

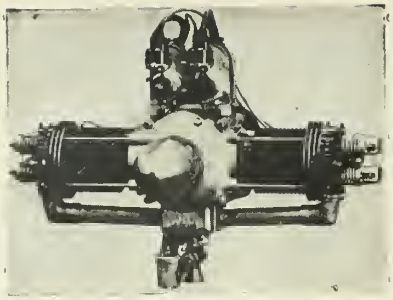
Germany's Auto Union A. G. introduced the D.K.W. of approximately 36 cu. in. displacement. This model has two inverted cylinders which are water cooled. As a maximum, about 20 hp. is developed at 4000 r.p.m. for a weight of 81.5 lb., which includes a reduction gear with a ratio of 1:2.55 or 3.18. The Bruno Von Festenberg-Pakisch engine, introduced in 1932, is a four-cylinder air-cooled radial which delivers 33 hp. for a weight of 136 lb.

More recently, some interesting two-cycle designs have appeared in France. The AVA-H4 engine is a direct-drive air-cooled four-cylinder opposed type of 85 cu. in. displacement, which has a rated output of 25-30 hp. at 2400 r.p.m. Aubier and Dunne introduced two new two-stroke engines, the first (Type Channel) being an 84.5-lb. air-cooled inverted two-cylinder in-line type of 35 cu. in. displacement, delivering 20 hp. at 4000 r.p.m. of the crankshaft and 1600 r.p.m. of the propeller. Three in-line cylinders of the same size in the Type Jaguar, weighing 117 lb., give a rated output of 27 hp. at 3200 r.p.m., the propeller speed again being 1600 r.p.m.

In addition to the two-cycle engines just mentioned, there have been some

●

Every one knows that, since the beginning of mechanical flight, progress in aviation has been gauged largely by the improvements in the design and manufacture of the power plant. Therefore, in our efforts to improve the performance and safety of flying craft, as well as expand the American aircraft industry as a whole, it becomes necessary that we lend support and encouragement to the development of engines in whatever field an apparent demand exists. The facts disclosed herein may indicate too little heed to this phase of development in the past.



Poinsard light plane engine

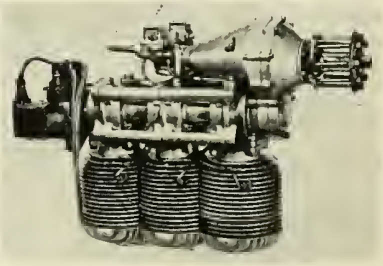
small four-cycle designs, among the latest being the Poinsard types produced by Etablissements Pierre Mengin. There are two models of the air-cooled two-cylinder opposed arrangement, Type B rated 28 hp. for a weight of 77 lb., and Type C rated 38 hp. and weighing 81.5 lb. Added to these is an interesting three-cylinder radial.

A compact engine of 244 cu. in. displacement and delivering 90 hp. at 2300 r.p.m. was introduced recently by General Aircraft, Ltd. of Croydon, England. This is an inverted 90° Vee type, with four air-cooled cylinders, known as the G.A.L. V/4. Besides being especially light for its output (the specific weight being only 1.9 lbs./hp.), the design is featured by the use of side valves and a Ricardo type combustion chamber, as well as a radical departure from conventional practice by the dispensation of even firing intervals.

Many other engines are being built in Europe at present, but we cannot devote space to individually mention any whose origin came at an earlier period. In England, for instance, Armstrong-Siddeley continues to manufacture a complete line of air-cooled radials; Pobjoy and Wolseley built small radial designs; de Havilland and Cirrus are known for air-cooled in-line engines; Bristol turns out several models of the radial variety; while Rolls-Royce, Beardmore and Napier continue with their rather well-known models. Leading Italian manufacturers—Fiat and Isotta-Fraschini — produce a complete line of engines as to type and output, and the same may be said of Avia and Walter in Czechoslovakia. The designs built by Argus, Siemens-Halske, Mercedes-Benz and B.M.W. in Germany are rather well-known, perhaps even more so than a variety of engines originating in other European countries, particularly the U.S.S.R., Belgium and Spain. France probably has more aircraft engine manufacturers than any other nation in Europe. Conventional air-cooled radial types are built by Gnome-Rhone, Hispano-Suiza, Lorraine, Farman, Salmson, Potez, Renault and S.F.F.A. Air-cooled in-line engines are produced by Renault, Salmson and Regnier (which we shall refer to later) and various types of liquid-cooled engines are the products of Farman, Renault, Lorraine, Hispano-Suiza, Panhard, Salmson and others.

A review of such a list is indicative of European superiority in the number of manufacturers and the variety of models. However, we are primarily interested in engines recently introduced, so there will be no further mention of any of the above manufacturers except in cases where a new type, or one heretofore neglected, has been added to the line.

Salmson took up the air-cooled in-line type in 1935, and Regnier is a fairly recent addition to the list of French aircraft engine manufacturers. The latter built their six-cylinder inverted engines—Model R-6, and later the supercharged R-161-01—especially for the Deutsch de la Meurthe Cup Races, and added a four-cylinder companion delivering 120 hp. Renault was the first firm in France to take up the revived air-cooled in-line type, and the work in connection with the development of racing types warrants special mention.



Two cycle Aubier and Dunne

The Renault supercharged six-cylinder *Bengali* engine powered the ship winning the Deutsch cup races in 1934. The normal rated output was 300 hp. at 2900 r.p.m. for a displacement limit of 485 cu. in. The 1935 edition of this design is rated 370 hp. at 3200 r.p.m. Besides this, Renault built an air-cooled inverted twelve-cylinder Vee type, of equal displacement and supercharged, which is said to deliver 500 hp. at 4500 r.p.m. for a weight of 682 lbs. A special model for speed events was boosted to 600 hp. at 5000 r.p.m. At this point it seems fitting to call attention to the fact that there are no competitions scheduled in this country which justifies such an expenditure of time and money, Menasco being the only one that has given such matters serious consideration.

In passing, mention should be made of the Farman 12Brs engine, which also was developed primarily for the Deutsch cup races. From this model was derived the 12Crs, an inverted liquid-cooled Vee type twelve-cylinder engine, which is rated 400 hp. at 3400 r.p.m. This engine employs a 2:1 Farman reduction gear, as well as the well-known Farman hydraulically-controlled super-charger of the two-stage variety.

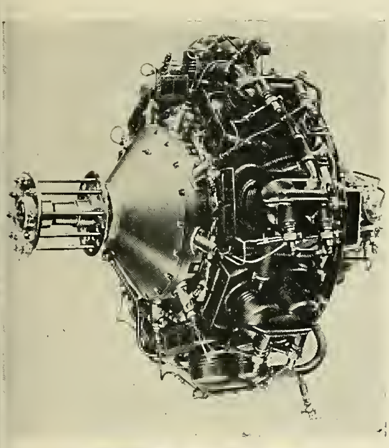
Among the comparatively new engines of note are the Hirth designs originating in Germany. These direct-drive air-cooled engines are built with four cylinders in line for an output of 70 hp., and eight cylinders in Vee form to deliver 170 hp. They incorporate several unique design features.

The air-cooled Napier-Halford *Dagger* is the first of its particular type to be presented. It is in H form, with two upright and two inverted rows of six cylinders each in parallel, which operate about two crankshafts geared together through a propeller shaft gear. This twenty-four-cylinder engine, which is said to deliver more than 600 hp., is an expanded edition of the *Rapier,* a sixteen-cylinder H-type which Napier & Sons introduced in 1930.

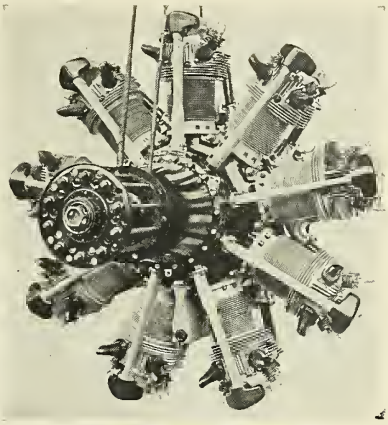
The sleeve-valve air-cooled radial engines, developed by Bristol in England, command attention. The development work on these nine-cylinder engines started some time ago, and is still in progress on the military types. However, in 1935, commercial types of the *Perseus* and the *Aquila* were placed on the market. The former, which has a displacement of 1513 cu. in., is rated 760 hp. and shows a specific weight of 1.51 lbs./hp.; while the smaller engine, of 916 cu. in. displacement, is rated normally at 430 hp. to give a specific weight of 1.74 lbs./hp. Reports on the performance of these engines indicate marked improvements over the conventional poppet-valve designs. No developments of like character in the U.S.A. appear to have reached such an advanced stage.

Obviously, the development of the Diesel aircraft engine has been accorded far more attention abroad than here. It is not our purpose to compare the performances of the three or more noteworthy American designs with any which are reported from Europe, but to bring out more forcibly the fact that the com-

Poinsard three cylinder radial



Salmson-Szydlowski Diesel



Bristol "Phoenix" Engine

pression-ignition principle is being adopted extensively over there, and is being applied to a variety of engine forms. It is particularly important to draw attention to the acceptance of the two-stroke cycle, since this seems the most logical course to follow in an effort to attain low specific weight in an aircraft engine of the compression-ignition type. Then too, we should recognize that the practical speed limitations of the two fairly well coincide, and that the Diesel is ideally suited to exploit the inherent advantages of the two-stroke principle of operation.

In England, only Napier & Sons are known to be exploiting the two-cycle Diesel, having taken a license to build under Junkers patents. The best known among other British efforts in the Diesel field are those of Beardmore, Rolls-Royce and Bristol. Beardmore built the *Tornado,* an eight in-line rated at 585 hp., in 1929, and it was successfully tested in the British Airship R-101. Subsequently, this firm built a flat engine, with twelve opposed cylinders to give 500 hp., which was intended for mounting in the leading edge of a thick monoplane wing. Rolls-Royce converted some of their twelve-cylinder *Condor* engines to operate on the compression-ignition principle, and not so long ago, Bristol introduced the *Phoenix,* a geared nine-cylinder air-cooled radial, rated 430 hp. at 2000 r.p.m.

Fiat was the first Italian manufacturer to experiment with the aircraft Diesels, converting one of their six-cylinder in-line engines. Later, Isotta-Fraschini followed a similar course and converted one of their designs to use the Brandt-Bagnulo system of injection. No information has been published lately concerning the water-cooled six-cylinder two-cycle double-acting heavy-fuel engine, rated at 980 hp., announced by its designer, Prof. Mario Behmann.

The Junkers double-piston two-stroke Diesels have been described so frequently in the technical press that we need devote no more space to them here. Other German developments in the compression-ignition field include the conversions of Mercedes engines, and the development of a powerful unit reported by the pioneering Diesel-engine firm, M.A.N.

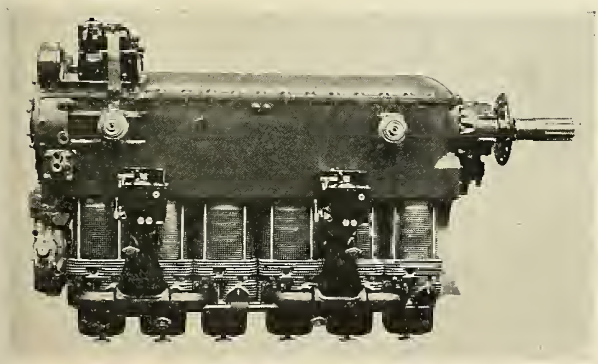
We find the names of six French manufacturers identified with the development of Diesel engines for aircraft. Compagnie Lilloise de Moteurs has secured a license to build the Junkers type. Lorraine-Dietrich has devoted considerable time since 1930 to the development of an air-cooled nine-cylinder radial. Recently, the Rochefort system of air injection was applied to an in-line group of six cylinders common to the Lorraine *Orion* engine. Renault is known to have experimented with the Diesel principle on an air-cooled nine-cylinder radial, as well as a twelve-cylinder Vee type engine.

The nine-cylinder air-cooled radial designs of M. Clerget have been described in several technical publications, and it is understood that Panhard and Levassor has taken a license to build both the 100-hp. and 200-hp. models. Recently, Clerget has been devoting attention to a two-row fourteen-cylinder design which is said to deliver 500 hp. normally, and 800 hp. when fitted with a Gnome-Rhone supercharger. Perhaps the most interesting feature is the double injection scheme with which it is aimed to secure more complete combustion and thereby maintain an even higher thermal efficiency.

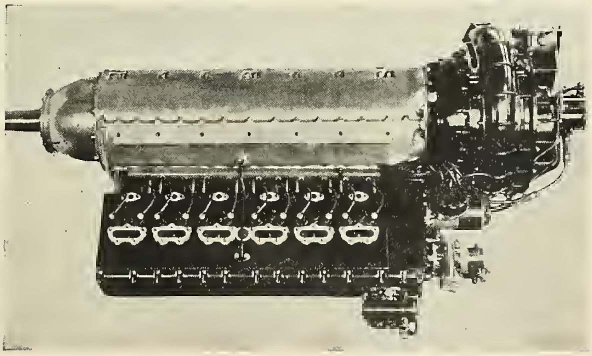
Current interest centers upon the Salmson-Szydlowski (SH-18) engine, which made its appearance in 1935. This is a two-cycle, compression-ignition engine with U-type cylinders, there being nine pairs of water-cooled cylinders in radial arrangement. The engine has a piston displacement of 1806 cu. in., and is said to deliver 600 hp. at 1600 r.p.m. for a specific weight of only 2.08 lbs./hp.

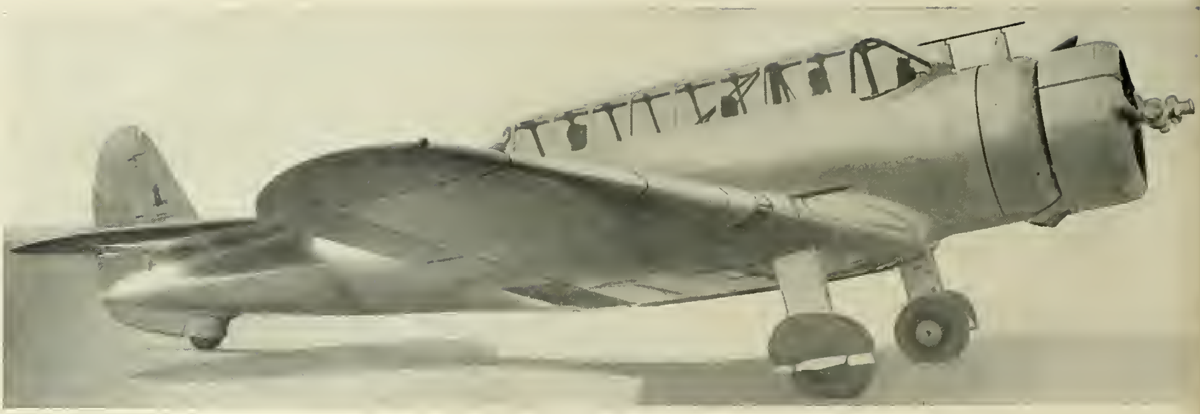
From this condensed survey of aircraft engine endeavors in Europe—regardless of their real merit, or their justification in some instances—we must admit that American designers are falling behind, at least, in the matter of quantity or diversification. During the past three and one-half years when, as previously mentioned, not a strictly new design has been awarded an ATC, we have noted the introduction of a number of new European engines in various power classifications. It has been shown clearly that the Diesel engine is receiving far more consideration in Europe, but also let us not overlook the fact that several other types of engines of high output are receiving more attention as well. Taken as a whole, this state of affairs certainly deserves careful consideration.

Renault "Bengali"



Farman 12 Crs.





VULTEE ATTACK BOMBER

● One of the most recent developments in military aircraft is the Vultee Model V-11, a two-place tandem seat, dual purpose, all-metal, low-wing monoplane designed for attack and bombing. In this plane Airplane Development Corp. engineers have endeavored to combine the high-speed performance and maneuverability characteristics of an attack plane with load-carrying and long-range features of a bomber.

Attention has been concentrated on the general arrangement to provide maximum vision, and on the installation of the military equipment with a view toward practicability, accessibility, and interchangeability from one type to another. Ease of maintenance on the field also has been a paramount consideration in the design of the different units of the plane.

Construction of the fuselage follows full monocoque design, circular in cross section, of uniform diameter from the engine section through the cockpits and tapering to a point at the tail cone. Shell plating is fabricated from unformed flat sheets wrapped over and riveted to U-shaped circular bulkhead rings spaced approximately 15 in. apart. Two longerons extend from the upper engine mount attachment fittings past the cockpit cutouts, and two web members are attached to lower surface of the fuselage through the wing section. These are the only longitudinal members or stringers. Lower web members support the external bomb racks and can be utilized as runners for the airplane in an emergency landing, with the undercarriage retracted. Overall length of the plane measures 37 ft. 11 in., and overall height is 10 ft.

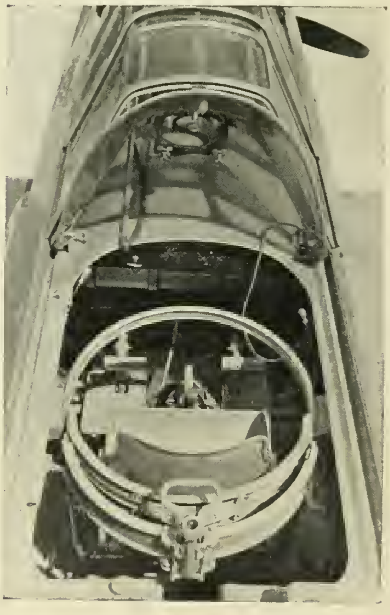
Wing loads are transmitted to the fuselage structure through built-up ring sections at the front and rear wing beams, these being continuous members passing through the fuselage.

Construction of the fuselage permits major repair operations by reasonably skilled mechanics without jigs or other fixtures. Damaged shell panels are removed by drilling out the rivets. They are then flattened and used as templates for cutting and drilling new sheet stock, the new panels fitting perfectly and maintaining fuselage alignment when attached to the undamaged sections.

Comfort and protection of the crew during extensive flights and high altitude operations is provided for by a roomy cockpit enclosure arranged to afford maximum vision in all directions with the sliding sections closed. Additional safety is afforded to the pilot in the event the plane noses over by the location of a tripod immediately behind his head. This tripod is designed to sustain six times the gross weight of the airplane.

Dual controls and rudder pedals are provided, the gunner's stick being removable. No flight controls or instruments, with the exception of engine controls, are in the gunner's cockpit. Flight control and the bomb release mechanisms as well as the control mechanism for the landing gear and wing flaps are located in a control pedestal mounted on the left side of the pilot's cockpit. Flight instruments, engine gauges, electrical meters, position indicators, warning lights, and controls are grouped on instrument panels before the pilot.

Gunner's cockpit with canopy retracted



Two three-minute flares are installed vertically aft of the gunner's cockpit. The wiring system for all electrical equipment is a 12-volt, two-wire ungrounded circuit shielded to eliminate radio interference and fire hazard. A complete Western Electric transmitting and receiving radio set is installed. The transmitter is arranged to transmit on three frequencies, using either phone or continuous wave telegraph. The receiver operates on two frequency bands for radio telephone or any modulated radio service reception. A pressure-type fire extinguisher is in the engine compartment and hand fire extinguishers are mounted in the cockpits. Heated fresh air is supplied through a controllable valve located in the cockpit and cold air for ventilation of the cockpit enclosure is also supplied through a controllable valve.

There is space in the rear of the fuselage for an aerial camera, bomb sight, or other equipment for observation without encroaching on fuel capacity. Provision is also made for mounting oxygen equipment, Very pistols and other signalling devices.

Welded chrome-molybdenum tubular construction is used for the engine mount and the engine mounting ring is supported by a truss structure. The mount is attached to the fuselage by bolts through four rubber-cushioned fittings. In addition to the engine, the mount supports the engine cowl, the oil radiator and

(*Continued on following page*)

"HE'S BEEN PAINTIN' COMETS NOW FOR A YEAR"

We really don't make comet paint just yet, but if someone has to have it, we'll set our researchers to work. It will probably have to be atom-proof, star-proof, rain-proof, ice-proof and what have you. But Sherwin-Williams has met the demands of the industry since flying's cradle days and doesn't intend to stop now. ▸ Our paints will not prevent tail-spins, ground-loops, or stalling. But they will do what we claim they will, and that is to give the highest degree of protection to fabrics, woods and metals over long periods of time. ▸ It is not surprising that S-W finishes will be found in the shops of flying schools, in the factories, and in private hangars everywhere. Casey Jones, who operates one of the country's best aviation schools in Newark, New Jersey, has used Sherwin-Williams aeroplane finishes for several years—and intends to in future. Quality tells the story. ▸ Write to the Sherwin-Williams Co., Cleveland, Ohio, and all principal cities.

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SPECIFICATIONS, WEIGHTS, PERFORMANCES

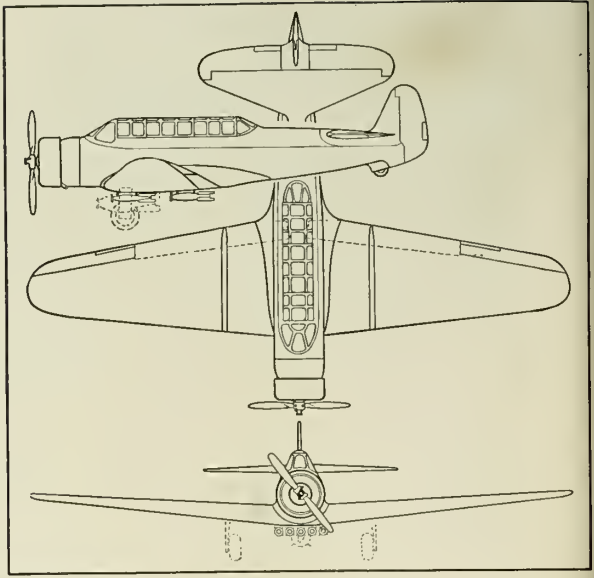
Wing span	50 feet	15.25 meters
Overall length	37 feet 11 inches	11.52 meters
Overall height	10 feet	3.05 meters
Wing area	384 square feet	35.71 square meters
Fuel capacity	500 gallons	1892 liters
Oil capacity	30 gallons	113.5 liters

Weights

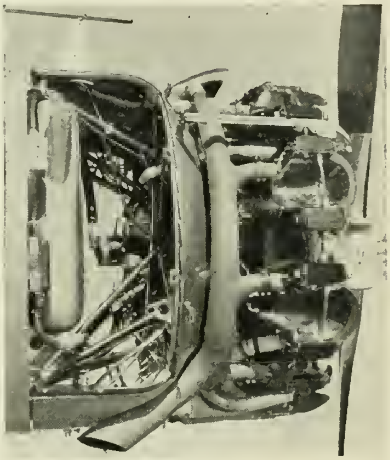
	(Attack)		(Bomber)	
	lbs.	kg.	lbs.	kg.
Empty weight	5512	2497	5512	2497
Useful load	2988	1353.7	5288	2397.6
Gross weight	8500	3850.7	10800	4894.6

Performances (Estimated)

	(Attack)	(Bomber)
Maximum speed at sea level (m.p.h.)	200	181
Maximum speed at 11,000 ft. (m.p.h)	230	209
Operating speed at 18,000 ft. (m.p.h)	217	193
Cruising speed at 20,700 ft. (m.p.h.)	210	185
Landing speed at sea level (m.p.h)	65	70
Rate of climb at 11,000 ft. (ft./min.)	1,100	600
Service ceiling (ft.)	24,000	19,000
Absolute ceiling (ft.)	26,000	21,600
Cruising range (miles)	900	2,200



Outlines of Cyclone-powered Vultee V-11



Power plant installation with nose cowl and section of inner cowl removed

(*Continued from preceding page*)

practically all other engine accessories. Quickly detachable connections are provided on all engine lines and controls, in order that an engine requiring overhaul may be removed and replaced by an overhauled power plant with little loss of time.

The wing has a span of 50 ft. and a total area of 384 sq. ft. It is an all-metal, full cantilever structure divided into three sections—a center and two outer panels. Primary structure of these sections is of stressed skin construction with spanwise corrugated strength members attached to front and rear shear beams and covered with smooth skin alclad sheet. Contour of the wing section is maintained by chordwise ribs and formers. Four removable nose sections and a removable tip section attached to the front shear beam give access to the interior of each outer panel. Ribs attached to the rear shear beams support the wing flaps, the flap and aileron mechanisms, and the skin aft to the trailing edge. Besides the landing gear, the center section panel supports the wing fuel tanks, the center section wing flaps, and the bomb racks.

Outer wing panels are attached to the center section by bolts through aluminum alloy forgings riveted to each corrugation of the outer and center panels and the flanges of the end bulkheads of the center section panel. Landing lights are installed in the nose section of each outer wing panel and navigation lights are at the wing tips.

The center section is attached to the fuselage by bolts through the main fuselage rings and fittings on the longitudinal runners.

Ailerons are aluminum alloy frame structures covered with fabric and attached to the wing by continuous hinges. Complete static balance is attained by a balance arm extending forward of the hinge center. Differential control action is used and a ground adjustable servo balance maintains lateral trim.

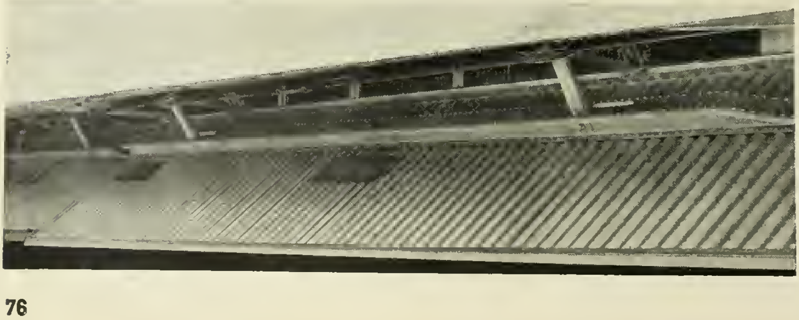
Split trailing edge wing flaps are used. The four sections of the flaps are 20% of the wing chord in width and extend from aileron to aileron with a small gap at the center of the fuselage. Each section of the flap is built of chordwise corrugations covered with smooth metal skin and strengthened by a centrally located spar. Each section of the flap is connected to the wing by continuous hinges, and the position of each is controlled by a cable sector- and arm-type actuating mechanism connected and operated by a continuous cable driven by a manually- or electrically-operated gear box.

The tail cone is a removable unit, of similar construction to the fuselage. It also is provided with a navigation light. Cone bulkheads are continued as spars of the fixed, stressed skin type fin. Fairings for the horizontal stabilizer, elevators and tail wheel, are also attached to the tail cone.

The stressed skin horizontal stabilizer is constructed similarly to the outer wing panels. It is rigidly attached above the fuselage forward of the fin and tail cone to avoid buffeting, and to improve control in a spin.

Rudder and elevators are of metal box spar and rib construction. The latter are fabric covered and the rudder is metal skin covered. An overhung balance is

Details of the split trailing edge flap



used on the rudder and each elevator is statically and dynamically balanced. An adjustable area of the Flettner type is provided on both elevators and rudder for directional and longitudinal trimming in flight.

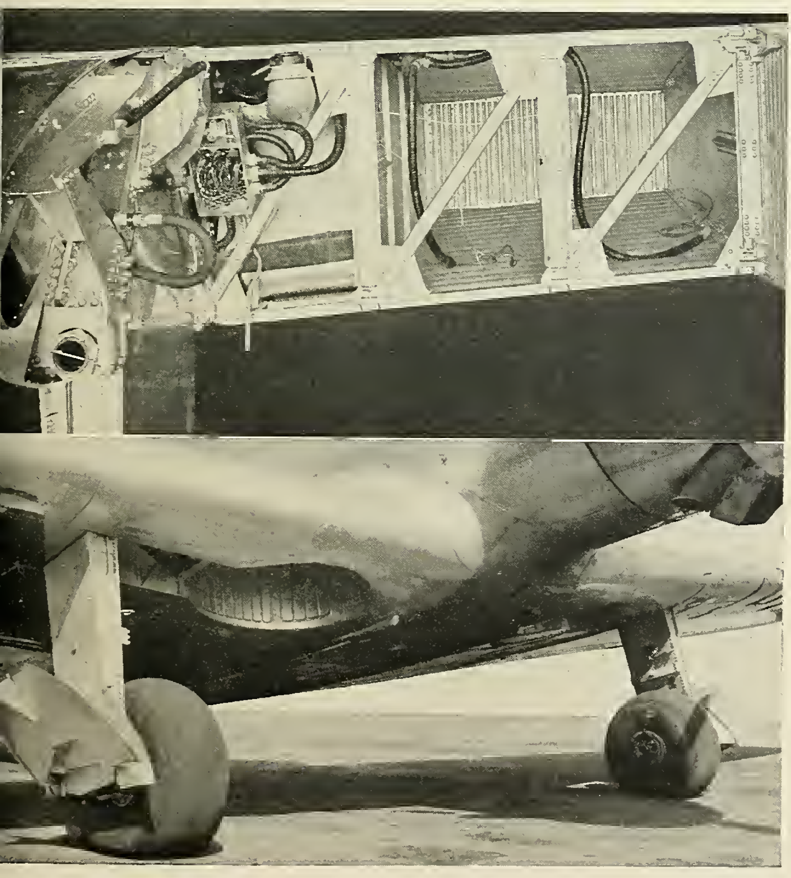
A fully retracting landing gear with a tread of 12 ft. is used. Shock absorption is obtained by oleo struts, rubber taxiing pads and airwheels. Each wheel and gear strut assembly is a separate unit which retracts into wheel wells and strut tunnels in the lower surface of the center section wing panel, providing a smooth surface for airflow over the wing section. Retraction is obtained manually or electrically by a system of torque shafts and bevel gears driving a worm and gear quadrant mechanism attached to the upper end of each landing gear strut. These struts pivot about bearing tubes and the operative mechanism rotates the struts inwardly into wheel wells. Position indicator dials are mounted in the pilot's cockpit together with warning lights and a signal horn which operates when the engine is throttled with the gear in any except the full down position.

Tail cone and fin assembly

The full swivelling type tail wheel is also partly retractable into the tail cone and lower rudder fairing. Shock loads are absorbed by a hydraulic oleo strut, and a coil spring is provided for taxiing loads.

Goodyear Airwheel tires, wheels and brakes are standard equipment. Wheel brakes are operated individually by foot pads on the rudder pedals, and together by a parking brake control in the cockpit.

Wing structure details and landing gear mechanism. Below: Vultee undercarriage



Either a Wright Cyclone SR-1820-F52 or SR-1820-F53 engine may be used. All units of the power plant are accessible for service and overhaul. The outer and inner engine cowl is aluminum alloy sheet, reinforced by stiffeners and mounted on brackets attached to the engine and the engine mount respectively.

Powered with the F53 which is rated 750 h.p. at 11,000 ft., and equipped with a Hamilton Standard controllable pitch propeller, the Model V-11, loaded as an attack plane, attains a maximum speed of 230 m.p.h. at the critical altitude and 200 m.p.h. at sea level. The maximum rate of climb at the critical altitude is 1,100 ft. per min. and the absolute ceiling is 26,000 ft. Loaded as a bomber, maximum speed at 11,000 ft. is 209 m.p.h. and 181 m.p.h. at sea level. Maximum rate of climb at the critical altitude is 600 ft./min., and the absolute ceiling is 21,500 ft. With normal load as an attack plane, range is 900 mi. at cruising speed; as a bomber with full fuel load, range is 2200 mi.

Oil supply is carried in a 30-gal. aluminum tank mounted on the firewall. Oil temperature is controlled by a radiator on the lower engine mount structure and a by-pass valve operated from the cockpit.

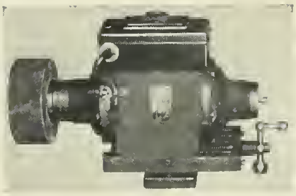
Maximum fuel capacity is 500 gal. contained in four wing and three fuselage tanks. These tanks are constructed of aluminum, shells and baffles riveted and welded together, and each is independently supported, filled, and controlled by selector valves. The reduction of fuel capacities as required by different loading conditions is accomplished by sealing or partly filling selected tanks.

Four .30 caliber Browing free firing fixed machine guns are mounted within the nose sections of the two outer wing panels outside of the propeller disc. Guns are adjustable laterally and vertically, manually loaded by cockpit charging handles and electrically fired by a trigger grip on the pilot's control stick. Each gun is equipped with 600-round ammunition boxes and ejection chutes completely enclosed within the contour of the wing.

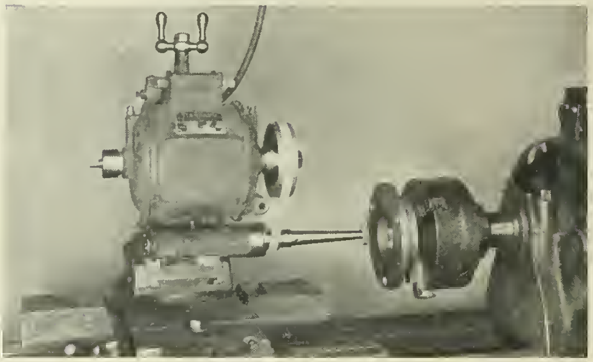
A .30 caliber Browing flexible machine gun is mounted at the rear of the gunners cockpit on a semi-circular gun track attached to the supporting members of the tilting and revolving gunners seat. Six hundred rounds of ammunition for this gun are carried in ammunition carton racks.

A 1200-lb. bomb load may be carried on internal and external racks in varied combinations. Internal racks are provided in stainless steel chutes for twenty, 30-lb. chemical or fragmentation bombs. External racks are arranged in two groups of five each in tandem, and support either one 1135 lb. bomb, ten 120 lb., three 285 lb. or two 625 lb., bombs.

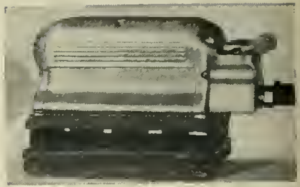
Notes on Machinery for Aircraft Production



Standard Internal-External Grinder



Standard Tool Post and Angle Plate Grinder



Sterling Speed-Bloc Sander

Standard Tools

Standard Electric Tool Co. drills, grinders, buffing and polishing machines for use in the aircraft industry are so diversified in use that they are not confined to any particular operation.

The portable electric drills are made in sizes from ¼" to 1½" and are used in assembly and maintenance. These drills are equipped with universal motors for operation on either alternating or direct currents of the same voltage. SKF ball bearings are used. Trigger switch is mounted in pistol grip handle and a feature is the strain reliever on the cable.

Standard tool post and angle plate grinders, made in sizes from ¼ h.p. to 10 h.p. are mounted on the compound rest of a lathe, the operation being the grinding of a shaft. Other uses include internal grinding, grinding of reamers, cutters and dies, connecting rods, bushings, lathe centers, etc.

To permit the polishing and buffing of a variety of work the Proper Speed Buffing and Polishing Machine was designed. The spindel overhangs the base 7" to permit handling of large work. A ball bearing motor is mounted inside the base on a hinged bedplate. The diameter of the pulley on the motor shaft determines the speed of the buffing spindle. The machine can be furnished with the spindle to operate at any speed required. The power is transmitted to the spindle by V cog belts.

This buffer is made in sizes ranging from 3 h.p. to 20 h.p. and can be furnished with three speeds.

Internal grinding may be accomplished with the Combination Internal and External Grinder which is made in ¼ h.p., ½ h.p. and 1 h.p. sizes, the internal grinding spindle operating at speeds up to 20,000 r.p.m. The machine is rearranged for external grinding by removing the spindle assembly. The angle plate in which both motor and internal spindle housings are attached is fitted with a dove-tailed slide. The aluminum pulley on the motor shaft is replaced with a 6", 8" or 10" grinding wheel, respective of the size motor used. The motor is then lowered in the dove-tailed slide for grinding on centers with the work.

Sterling Sander

In aircraft manufacture special treatment from the standpoint of hand sanding is required on metal fuselages and wings, plywood or fabric covering, and propellers. Each of these groups calls for specialized sanding operations, and the standard finishes on the above require uniformity, quality and speed of production. Flexibility of the sanding or finishing medium is the prime requisite in order to assure uniformity of finish on curved surfaces. The workman's hand is readily adaptable, because it easily follows and conforms to the surface being treated, but due to its form the hand does not present a uniform surface, and therefore does not give full contact or pressure of the abrasive on the product.

A second requisite in modern finishing is the reciprocating (forward and back) motion, to which the hand readily adjusts itself. However, a continuous motion in one direction, or long reciprocating strokes such as are common with hand sanding cause a tendency to "drawing", or rolling of the particles loosened from the abrasive between the paper and the work. These particles cause gouging or scratching of the surface until they are thrown out of the path of abrasion.

Many bare metals requiring a high type of finish, such as propellers or stainless steel products, and others that require conditioning before paint is applied, have various inequalities, including scratches, burrs, excoriations, etc., which must be removed. While a grinder, disc sander or file may be used as a first step in cutting down these imperfections, hand sanding is still necessary in practically all cases to give a satisfactory surface for final treatment.

The Sterling *Speed-Bloc* Sander has been developed as a mechanical substitute for hand sanding operations, and has the advantages of hand sanding without the attendant disadvantages. It follows curves and variations of surface, and gives uniform results as to contact and pressure. The rubber and fabric bridged construction of the sanding block makes it flexible, and therefore adaptable to curved, as well as flat surfaces, with uniform contact and pressure throughout the area of the block. A felt underpad on the bottom of the bridged block cushions the abrasive paper. The sander is a pneumatic tool, working most efficiently under an air pressure of 60 lbs./sq.in., and under operating conditions uses slightly more than 6 cu. ft. of air per minute. It is equipped with water connections so that when desirable, water may be sprayed on the work through a series of openings in each side. All parts which might come into contact with the work are of rubber, eliminating possibility of marring or scratching.

The machine oscillates at a speed of 3000 per minute, and has a stroke of ⅝". The motor is sensitive, and reacts quickly to changes in manual pressure, yet is powerful enough (developing a torque equivalent to ¾ h.p.) to keep the operator from stalling it by hand pressure. The Sterling is 7" long, 4¾" high, and 3¾" wide and weighs slightly over 7 lbs.

Abrasive paper is held in place over the felt cushion on the bottom of the flexible sanding block by a spring or rubber clips, which slip into grooves in the block. Lubrication of the machine is accomplished either by manual introduction of oil into the air inlet, or by use of an automatic lubricator.

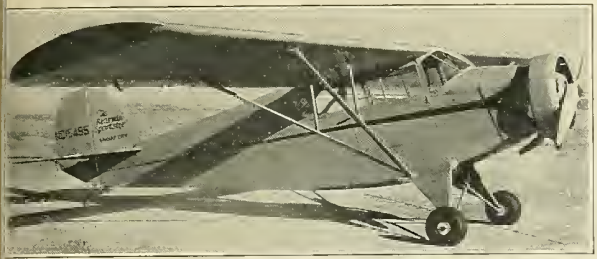
To maintain the required constant pressure, a pressure regulator is necessary. The Sterling unit is featured by simple design, and minimum parts. An all die-cast construction combines sturdiness, compactness and light weight. Replaceable clamped diaphragms, machined, eliminate the use of solder. A safety valve prevents overloading.

Automatic Lathes

Fay Automatic Lathes, manufactured by Jones & Lamson Machine Co., are machines especially adapted to precision production work where multiple tooling is of primary importance. These machines, built in 8", 12", 20" and 24" sizes, possess setup features which make them practical for runs on smaller lots. To these standard machines a series of standard attachments may be added. With these standard elements and a minimum of highly specialized equipment a most practical special purpose machine results. When these statements are applied to certain problems that arise in the construction of engine parts the results become apparent.

These lathes are equipped with a cam drum or drums giving sufficient cam space for desired motion to operate special equipment as well as standard attachments. The front carriage and the back arm, which carry the cutting tools, are mounted on large diameter bars that receive their movement directly from hardened and ground formers which are fed by hardened steel cams

(*Continued on following page*)



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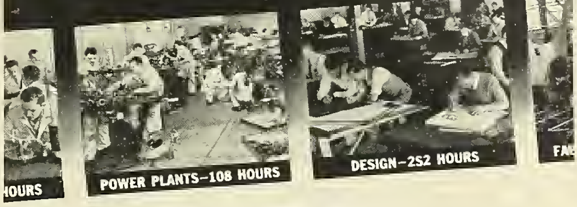

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(*Continued from preceding page*) mounted on the outside of the drums.

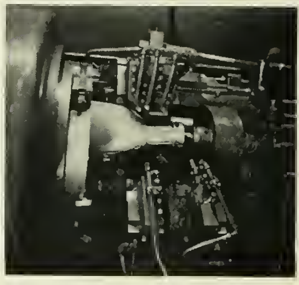
The 20" × 28" Fay Automatic Lathe was recently adapted to the turning of 3-blade propeller hubs. The work is held between centers; the two hubs, which are not being machined, are held by the floating drive plate and act as driving units. The machine, with the same tooling, can be adapted to the turning of 2-blade hubs by changing the driving plate on the chuck. The carriage turns the taper relief between the bearing diameters. During this time the back arm faces and chamfers. The carriage then rocks back, relieving the turning tools and brings four form tools into position. The carriage then feeds forward and forms out the semi-circular relief and the square groove in the face of the hub. Double formers positively control the carriage while grooving. A floor to floor time of 6 min. 24 sec. per arm is obtained.

A lathe can also be used for finish turning engine cylinders which come to this operation finish bored and the crankcase end rough turned. The thread end is rough and finish turned. It is held on air operated spindle and tail-stock fixtures and located by a plate contacting the side of the first fin. The carriage finish turns the O.D. and chamfers the bore on the crankcase end while the back arm faces, forms and chamfers.

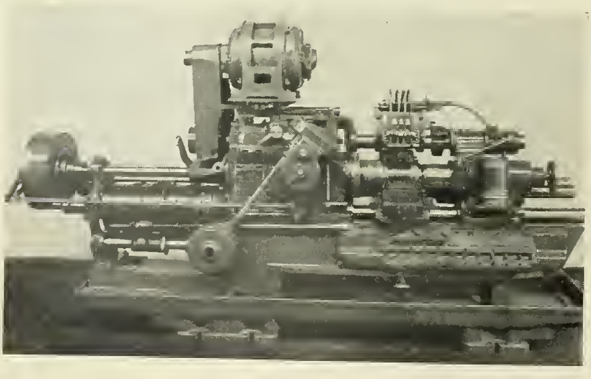
The standard 12" Fay Automatic Lathe with special center drive attachment is adaptable for turning duralumin propeller shanks. The carriage rough and finish turns the straight and taper portion of the shank. The rough turning tools are carried in the upper part of the block and the finish turning tools are in the lower part of the block. The same taper turner tool is used for both roughing and finishing. The back arm has an auxiliary slide which carries tools for rough facing the shoulders and the end, and rough forming the groove. Other tools are carried on the back arm proper for finish facing the end and shoulders, finish forming the groove, and chamfering the end.

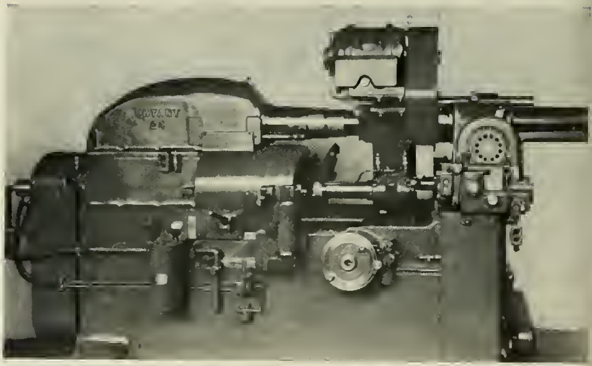
The next cylinder operation is finning. The finned portion is 7½" in diameter and the fins are 7/16" deep and 5/32" apart. The work is held and driven by an air operated expanding fixture gripping in the 6⅛" bored hole, and supported by a large bull center in the tailstock. The carriage rocks straight in, carrying 36 tools which remove the greater portion of the stock between the fins. The back arm and the top arm rock in to profile the sides of the fins. The back arm profiles one side of each fin and the top arm profiles the other side.

Another development of the Jones & Lamson Company, the J. & L. Comparator and Optical Inspection Machine, is used in the aircraft industry. Designed to check a variety of tools, gages, and products, it is applicable for rapid inspection of poppet valves.


Turning propeller shank on Fay Lathe

For checking concentricity of seat, a motor for rotating the valve is fastened to the end of the table. This motor operates a rubber driver which comes in contact with the head of the valve. When the motor is started the shadow of the master remains constant on the basic line. The master is then replaced by the valves to be tested.

Flanders type Fay Lathe



Bryant 24 Deep Hole Grinder applicable for finish grinding on radial engines

Bryant Grinders

The principle of the suspended wheel slide is the feature of Bryant Internal Hole and Face Grinding machines, in which the suspended wheel slide consists of a wheel spindle support attached to the overhead cylindrical bar which takes the place of the conventional table slide usually used. This bar is supported in cylindrical bearings in which it is allowed to slide and turn giving longitudinal traverse motion and also diameter control for the grinding wheel. The design is advantageous for better wheel control as it involves the use of one slide, providing greater ease in maintaining accuracy.

In the Bryant design there is always pressure of the wheel slide in the same direction against the cross feed screw. The counterbalanced wheel slide takes up the back lash of cross feed screw and, consequently sizing to the closest limits is simplified.

The grinding wheel is midway between the cross feed and the axis of the wheel slide bar, so that .0002" at the cross feed gives .0001" at the work. Because of the suspended wheel slide it is possible to arrange a standard machine for the grinding of unusual jobs such as drawing dies, stepped holes, combinations of straights, tapers and curves, cams and other out of round holes with minimum special equipment.

Bryant grinders are built in a variety of sizes which permit grinding work from ⅛" diameter up to a swing of 38".

The No. 4 and No. 5 Bryant Grinders are similar in all respects with the exception that the No. 4 Grinder is equipped with automatic sizing. All sizes are arranged for grinding either straight or taper work but the No. 4 and No. 5 machines can be furnished in what is known as the "B" type which has an adjustable workhead for grinding tapers with exceptionally steep angles. All machines have power for wheel slide furnished through crank traverse mechanism for work which requires a short stroke of wheel slide.

These machines can grind cam rollers, rocker arms, small gears, bearings, or other small parts used in the assembly of aircraft engines.

The No. 16 Bryant Grinder has a hydraulically-operated wheel slide and like other Bryant grinders has one single control lever for operating all parts of the machine. This machine is built with a swing of 16", 28" and 38" and can also be furnished with a two spindle slide for grinding of bore and face at one chucking of the work. Capacity of the No. 16 is suitable for grinding connecting rods including grinding the main bore, wrist pin bore and radially spaced bores of master rods as well as the bore grinding of the articulated rod.

With special attachment it is possible to grind the outside diameter of intake and exhaust cams for radial engines as well as the bore and face of the same parts. Machines equipped with micrometer stops for facing, work to depth and are suitable for grinding of gears, bushings, propeller hubs.

The No. 24 Bryant Deep Hole Grinder, built in 21" and 31" swing, is used extensively for finish grinding of engine cylinders, connecting rods and crankcases for radial engines. There are a number of operations on aircraft engine parts which demand great accuracy in grinding of bore and in many cases two or more surfaces must be in true relation with each other. For example, some of the master rods require the radial spaced holes to be ground with a taper bore on one end and straight bore on the other. With the Bryant grinder (through the use of a special control bar) it is possible to grind the straight bore and the taper bore with one stroke of the wheel slide.

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SEE PAGE 33

TEXACO *Aviation* PRODUCTS

TEXACO AIRPLANE OIL ★ TEXACO AVIATION GASOLINE ★ TEXACO MARFAK ★ TEXACO ASPHALT PRODUCTS
(for runways, hangar floors, aprons and dust laying)

EQUIPMENT and METHODS

Photographing Skyscrapers

The things which make New York one of the most interesting of all photographic subjects also make it one of the difficult to photograph successfully from the air. Close-ups of a tall building, for instance, are apt to make the structure appear tilting at a precarious angle, while flying too low over the city not only involves some hazard, but also violates air commerce regulations.

The Fairchild aerial camera designed especially for photographing skyscrapers

Fairchild Aerial Camera Corp., therefore, recently developed for Fairchild Aerial Surveys a camera which is designed specifically for the purpose of photographing skyscrapers and special views of New York City.

This long range camera has a focal length of 24 in. and an overall height of 3 ft. Loaded it weighs 60 lbs. The cone which supports the lens also protects it and the mechanism from dust and the airstream. The camera has an F.6 lens, between-the-lens shutter and a magazine holding 75 ft. of film, sufficient for 110 photographs, each 7 × 9 in.

Using this camera, the photographer can fly twice as high as he did before and yet get even more detail than he could secure at the former altitude. Or he can fly at the same altitude and secure an even more intimate view than before. The camera embodies many characteristics of the intelligence cameras developed for the military services. These were designed to assure the same size and clearness of detail when operated at high altitudes (between 25,000 and 35,000 ft.), in accordance with modern military practise as characterize photographs taken from altitudes of a few thousand feet.

Hydraulic Pump

A hydraulic pump designed on a new principle, employing a flywheel as for a punch press, has been developed by the Hydro-Motive Co., Chicago.

A directly connected 1200 r.p.m. motor drives a crankshaft and flywheel. The crankshaft is laid in roller bearings and reciprocates four pistons 90° apart sealed by piston rings; also two spool valves 180° apart which likewise are sealed by piston rings. Normally the fluid is circulated through an idling valve from the crank-housing which is also the reservoir. When the idling valve is in working position, the fluid is conducted through another spool valve with two outlets. This valve is controlled from a pressure-regulating valve so that when fluid reaches a pre-determined pressure, the valve is moved automatically and conducts fluid through the second outlet, and when the pressure in this outlet reaches a pre-determined pressure, the idling valve is automatically moved to idling position. By the use of a flywheel, hydraulic cylinders may be operated at the same speed and economy as crank presses.

The pump has ¾ in. diameter pistons with ¾ in. stroke, a capacity of 5.6 gal./min., with a maximum working pressure of 5000 lbs. and uses a ⅓ h.p. motor.

International Hangars

Permanent, attractive and low-cost hangars, of all-steel or masonry and steel construction are being constructed by International Steel Co., Evansville, Ind. All-steel hangars contain a number of features designed to assure weathertightness and improve appearance. These include formed sheet for eaves, Gable box-type and window flashing, and corner trim. Single or double all-steel welded service doors in any size and with either solid panel or glass are available. Steel beaded or corrugated sheets are used as a cover for the hangar. Sidewall windows are made of heavy steel sections, with pivoted ventilators having 2-point contact weathering.

Doors are rugged and well-balanced for easy operation. Rollers are mounted on parallel tracks at bottom and are equipped with ball bearings, fittings and a sensitive wheel lock. Guide angles and rollers at the top keep doors in perfect alignment.

Roof truss is of the bowstring truss type, supported on steel columns which gives a clear floor space and ample ceiling height.

Cotton Fabrics For Runways

With substantial sums being made available by the WPA for airport improvements throughout the country, interest attaches to the adaptation of the cotton road principle to the construction of airport runways.

C. R. Andres, Newark, N. J., City Engineer, with the approval of the Bureau of Air Commerce, has announced that plans for the improvement of Newark Airport specify a cotton fabric membrane reenforced asphalt surfacing for one of the principal runways there. Army engineers are using similar construction in the improvement of runways at Riley Field, Fort McClellan, Ala.

According to Major B. E. Gray, Chief Highway Engineer of the Asphalt Institute, there is a great deal of merit in the incorporation of a suitable cotton membrane in surface treatment work. There are many situations where failure of the bituminous mat is avoided by reason of the reenforcement obtained through the cotton, and he believes that in many airport runway situations this use would be advisable.

In connection with this matter of airport construction, there has been considerable discussion as to the stresses set up, especially under the large transport planes. It is the consensus of opinion of many engineers that there is no difference in regard to the stress in an airport runway as distinguished from a road surface carrying equivalent traffic loads. As a matter of fact, the stresses on an airport should be materially lower than those on a road because of lack of repetition of load on the same spot.

It is important on airport surfaces that a dense waterproof seal be obtained because of the large area involved and the necessity of keeping water from going through the surface to the sub-grade. By taking pains with this seal, less expensive foundations are required, and consequently the entire airport runway is built at a saving in cost. Some sort of a mix-in-place foundation will serve most locations, followed by a dense seal coat using either cut-back asphalt, an emulsified asphalt or a soft asphalt cement. All of these materials work well with the cotton membrane.

Sleeper Plane Heaters

Sleeper planes may be heated in the hangar by a 9 k.w. Electromode electric air heater, which operates by connecting its cable to any convenient outlet.

After the heater is placed in the plane, a master tumble switch is turned on and fan begins to operate. Then switches on top of the heater are turned on. At this point 9 k.w., or 30735 b.t.u., or 128 sq. ft. of radiation are in operation, being distributed by 650 c.f.m. As soon as the temperature of the air reaches 72° F., one of the G.E. thermostats cuts off 4½ k.w., thus slowing the temperature rise. When the temperature of the air reaches from 74° to 76° F. as is desired and set on the thermostat, the remaining 4½ k.w. are cut off. After this, the fan circulates the air until the radiation loss reduces the temperature about 3° when the last off thermostat is the first to cut in 4½ k.w. If this is not sufficient, the second thermostat cuts in the second 4½ k.w.

Electrode electric air heater installed in the cabin of a Curtiss-Wright Condor

Usual performance is limited to the use of 9 k.w. to heat the plane quickly, and an additional 4½ k.w. is ample to carry the desired temperature under any weather conditions.

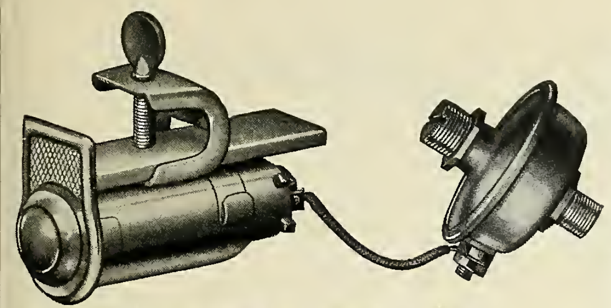
The capacity of the Electromode Electric Air Heater in c.f.m. and k.w. is sufficient to raise the interior of the plane from 35° to 73° F., in 10 min.

Portable Unishear

A portable electric shear known as Unishear No. 16 has been brought out by The Stanley Electric Tool Division.

This unit is designed primarily for shops producing work on tough sheet materials or for job shops that cut up to 16 gauge hot rolled steel.

Some of the features listed by the manufacturer are feed speed up to 15 ft./min.; cuts straight lines, curves, angles and notches without burr or distortion; inside cuts are easily made after punching a 2 in. hole for the yoke; and has a pivoted duplex handle.



Klemm Fuel Pressure Indicator for aircraft

Fuel Pressure Indicator

A new unit which gives visual indication that a fuel tank is running dry and that another tank should be switched in, has been developed by Klemm Automotive Products Co.

Known as the Klemm Fuel Pressure Indicator, this 8-ounce unit supplements the regular fuel gauge or fuel measuring instrument. While these instruments show the amount of fuel in the tank, they do not definitely draw the pilot's attention to the gauge until the tank is dry. The fuel pressure indicator provides a compelling warning flicker, then a flash, and then a glare, holding its warning beacon until the new supply is started.

The heart of the indicator is the control unit itself. This unit, made of steel, brass and a special diaphragm bronze, employs a new development in mechanical sealing. It is ruggedly constructed for aircraft service, is compact, and adjustable.

Practically all makes of planes have pressure feed fuel systems for their fuel. When this pressure drops to approximately 2 lbs., the diaphragm comes in contact with the contact bar. A pressure change of only a few ounces is necessary to make the contact required to light the signal on the instrument panel.

In addition, two other Klemm indicators are available; for oil line pressure and reduction gear oil pressure. The latter has been calibrated for geared Wright Cyclone engines but is available for all radial or in-lines.

Stanavo Control System Oil

Standard Oil Company of New Jersey has developed a new petroleum substance which it has added to Stanavo Servo Oil to increase its viscosity index, thus making this product more suitable for use in automatic airplane controls where the viscosity of the fluid used in the hydraulic unit must not vary greatly in changing temperatures if accurate operation is to be secured. The addition of this substance it is felt has made Servo Oil desirable for use in automatic pilot mechanisms and in oleo shock absorbing systems.

Rating of an oil as regards its viscosity change with change in temperature is standardized and is known as the Viscosity Index (V. I.). The higher the index the less the viscosity changes with temperature changes; the lower the index the greater the change. Oils containing this substance will be available for other hydraulically operated units which are forced to function in a wide range of temperatures. Such oils are particularly desirable in aircraft, where there is a variance between ground temperatures and temperatures prevailing at altitudes.

Reading Aircraft Battery

A new battery designed especially for aircraft service has been developed by Reading Batteries, Inc., after extensive development tests. The battery features as its principal advantage the fact that it is non-spillable and may be inverted for long periods without damage and without dangerous leakage.

New construction has allowed elimination of the conventional chamber above the plates, making possible the use of 25% more active plate surface and 50% more active material, without increasing overall dimensions. While more electrolyte is used, it presents no new problem since it is absorbed by the insulation.

A hard rubber master cover which is not only self-ventilating but also a protective agent of the terminals is utilized. With this cover and because no drain is required, it is not necessary to install the battery in a conventional metal battery container. Ribs are moulded in the battery box, between which a metal band can be fitted to firmly secure the battery wherever the installation is to be made.

Other features include the elimination of hydrometer readings which are replaced by voltage ratings obtainable while the battery is in place; the periodical addition of water by removing the master cover; and little evaporation.

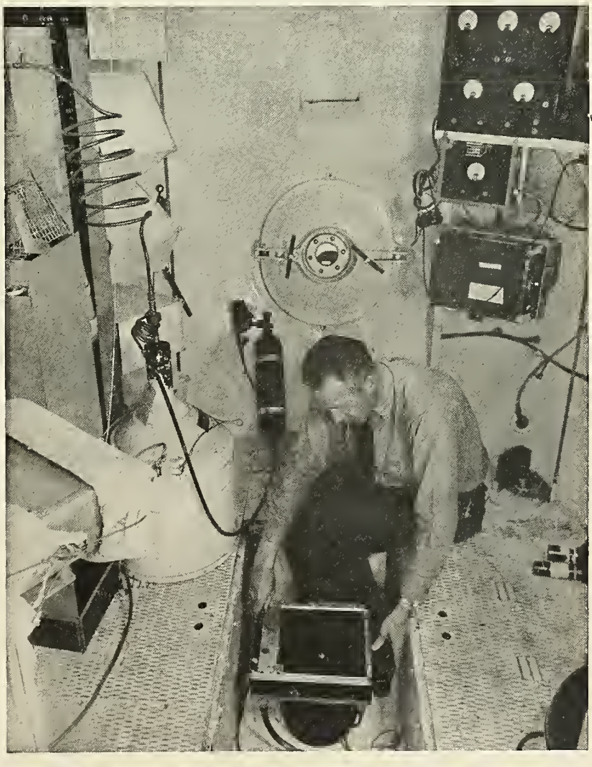
Aerial Photography from 72,395 Feet

Photographs taken by Capt. Albert W. Stevens from the stratosphere while the balloon *Explorer II* was at its ceiling of 72,395 feet over Parmelee, S. D., show the earth's actual curvature on the horizon more clearly than ever before. These pictures, which reveal how the world looks from the greatest height at which pictures ever have been made, have just been developed from films exposed during the flight which was sponsored by the joint efforts of the National Geographic Society and the U. S. Army Air Corps.

The picture showing the curvature of the earth includes a stretch of the horizon 220 mi. long, representing more than 3° of a circle, or practically 1/100 of the earth's circumference. The horizon's curve is noticeable when the picture is projected on a screen, or when the edge of a ruler is laid along the horizon line.

In this picture, the Fairchild K-11 camera, which was mounted in the side of the gondola, took the horizon at a distance estimated to have been 300 mi. from it. The photograph was taken by infrared light which is capable of piercing distance haze. All other colors of sunlight are shut out of the camera by a red filter in making this kind of a photograph. The picture shows a vast stretch of western South Dakota, covering roughly 33,000 sq. mi. The Black Hills, from which the flight started and which have an area of about 6,000 sq. mi., appear as a large dark area at one side of the picture 160 mi. in the background. Mountain peaks, rivers, and in the foreground towns and farms, are visible. The horizon line is represented by a stratum of haze estimated to lie about 10,000 ft. above the earth, and which, however, conforms closely to the sea level surface of the earth. Its curvature reflects accurately the curvature of the earth itself.

Both still and motion pictures were taken directly downward from the stratosphere balloon while it was at its maximum height. They reveal the earth as a huge plain marked with tiny checkerboard-like farms and fields. Cutting into the farm lands are regions of erosion, with small stream courses, arroyos and creek beds. Roads appear as thin, knife-edge lines, and towns are practically invisible. The still pictures of the earth were made automatically every 90 sec. with a Fairchild K-3B aerial camera mounted in the bottom of the gondola.



Captain Stevens and the Fairchild K-3B camera which was in the floor of the gondola

Personairlities

By Caldwell

● LEE GEHLBACH, the well known test pilot and parachute jumper, was born Oct. 6, 1902, on a farm near Lincoln, Ill., and is still with us thanks to the efforts of a herd of silk worms. But he's been using up his chances rapidly, and at the rate he's been travelling lately even Lloyds wouldn't bet on how long he's going to last. In May of last year and again this past summer he was forced to leap for his life from airplanes. The way I analyze the situation is that two strikes have been called on Mr. Gehlbach and three strikes are out in any league.

It's a funny thing, and I don't pretend to explain it, but there's something about the testing of airplanes which drives pilots to desperation and writing for the papers. The late Jimmy Collins achieved some success as a writer and was going to give up testing—after one more test job. It was one too many. Bill Wheatley, test pilot for Consolidated, helped write a technical book; and Gehlbach has written articles on testing and racing. As for myself, it's well known that only such an awful job as testing miscellaneous airplanes could have forced me into the writing racket. It just goes to show the depths to which continual nerve strain will lower an otherwise respectable citizen. C. G. Grey hasn't even that excuse for becoming an editor—he never was a test pilot.

Now, when I speak of testing I think back to the old kid-glove period, when we took a new type very gingerly into the air, placed as little strain upon it as we could get away with, and gently brought it down. After we got rid of the thing we never cared greatly if the engine fell out of it—in fact, the engine did fall out of one that I had presented to the Navy with my blessing. But that was due to propeller failure, and it was the Navy's own pet design of propeller, so we weren't to blame. But in those dear dead days about all the tests that we had to do with a heavy ship was to fly it, demonstrate that it was a reasonable flying machine, that it would do a certain specified speed and climb with a designated load, and that nothing would fall off of it in normal flight.

It was very much different lately. If you built the Army or Navy a dive bomber, for example, they'd just look at you with a sly grin and say, "Let's see you dive it and grab yourself 9 G's." These G's represent so many times the normal force of gravity exerted when the plane is pulled out of the dive. In other words, at 9 G's the wings are supporting nine time the normal weight of that airplane in level flight. And the G's are registered on an accelerometer, so you can't cheat on them. Lee says that a pilot should be able to stand up to 12 G's okay, and from 12 to 14 G's with internal injuries, but that over 14 is too much. Personally, I'll take a gin fizz.

Of course the ship is stressed to take these enormous strains, but nature has a nasty habit of stacking the cards against engineers and test pilots. Suppose, for instance, that the pilot, having dived to terminal velocity, begins to pull out, and is watching the accelerometer slide right up to 9 G's. At that very moment the ship hits an upward gust—and the G's hit 14. The safety factor is considerably diminished, and sometimes the airplane is too. That's why some test pilots think the G's should be carried only to 7.5 instead of 9, to allow for possible gusts, inaccuracies of instruments, and possible overcontrolling by the pilot. After the death of Jimmy Collins the Navy Bureau of Aeronautics agreed with the pilots. The requirement now is 7½ not 9 G's. That is still plenty. I know that when I heard about these G's I marvelled at the keen analytical judgment which had caused me to give up testing at a time when it still was a sort of jolly game.

Lee Gehlbach

Now just to show you what a social liability this testing of airplanes has become, I'll give you a couple of incidents from Lee Gehlbach's career. Last May he was running tests on a new torpedo bomber which weighed about five tons fully loaded. Everything was going very well, and Lee was as merry as a cricket as he pulled out of a dive at 8,000 feet and watched the G's pile up on the accelerometer. Suddenly he heard a loud report, like one of Eugene Vidal's bright ideas for $700 airplanes blowing up, and instantly a large loose collection of wing parts came back through the windshield and disappeared to the rear. He blinked, looked outside, and discovered that he was sitting in a bare fuselage headed straight down. The wings had vanished. In another moment, so had he—he is a quick thinker and mover, The parachute opened when he had about 500 feet of height left, and let him gently down among some slender saplings. Strike one!

It took only a dozen stitches to join his scalp together—part of the wing had brushed him. Two days later, with two black eyes and thoroughly plastered with head bandages, the indomitable Gehlbach showed up at another factory to test another military ship. The company and the Navy officials thought they were seeing a ghost, and called for the doctor to give Lee a physical examination. The damage was all on the outside, so up he went, and all tests went like clockwork. Then he took the ship to the Navy proving grounds at Dahlgren for final tests, and again everything went smoothly, maneuvers and dives, until there was only two ten-turn spins left to do, one to the right and one to the left. After completing ten turns of the spin, Lee proceeded to turn it off. But that spin just wouldn't turn off. Mr. Gehlbach went through all the movements advised in such circumstances by the oldest and soundest inhabitants of aviation, last of all standing up in the cockpit and leaning far forward in the fond hope that the change in air pressure and balance might help. He might as well have tried to get Italy and Ethiopia out of a spin.

Since he had started his spin from

12,500 feet, the rapidly revolving test pilot had time to try all the tricks he knew, but he just couldn't pull the rabbit out of the hat. At 2,000 feet he sighed gently and went over the side—he was used to it by this time, and was beginning to consider his parachute the normal means of descent employed in the more expert testing circles. A spinning airplane, however, doesn't go in any direction but down, which was the only direction that Mr. Gehlbach had to go. So down went Mr. Gehlbach, and down came the airplane, apparently directly over his head. At 400 feet above dear old Mother Earth it was necessary to take a chance, then or never. Lee took it, and pulled the rip-cord. The parachute opened—and the interested Mr. Gehlbach watched his airplane go spinning past him, only a few feet away, to smash into a tree, while the lucky test pilot sat down easily enough on some freshly ploughed ground nearby. Strike two!

These two incidents caused the spring and summer of 1935 to glide by with the minimum of monotony for Mr. Gehlbach, who always laughs delightedly when he recalls these experiences. He is growing hardened to having things happen, for he has been doing these high dives since 1933. In one dive in a dive bomber the stick suddenly started jumping from side to side, battering his knees. He pulled out of the dive, slowed down, and landed. A bolt missing from an aileron hinge had allowed an aileron flutter to set up in business. Luckily, the aileron and wings stayed on. From that time on bolts and cotter pins were triple-checked, instead of only double-checked.

By such hard testing processes, all difficulties are found and corrected. When the Navy ordered a few squadrons of those bombers they knew that they would do the job for which they were intended. Nothing was left to theory. The first production plane of that contract was given the same tests, and stood them with no difficulties. Our Navy goes in for harder testing than any other organization anywhere, and as a result is getting the finest airplanes in the world. All honor and credit to the factory test pilots who have the skill and the courage to go through with such tests as are demanded to-day.

Lee Gehlbach graduated as an Engineer from the University of Illinois in the Class of 1924, enlisted as a flying cadet in the U. S. Army on Sept. 14, 1924, and graduated from the primary flying and advanced pursuit flying schools of the Air Corps. Commissioned a 2nd Lieut., Air Corps, Sept. 8, 1926, he spent three years with the First Pursuit Group, Selfridge Field until Sept. 30, 1929, since when he has chiefly engaged in test work, including engineering, under contract for various companies, among which are Stout, Monocoupe, Verville, Command-Aire, Bird, Hisso, Issoudun, Hurd, and Grumman. From 1933 through 1935 he was chief test pilot for Great Lakes Aircraft Corp. His racing experience includes the All American Air Derby of 1931, in which he was the winner; National Air Tour, 1931; Wedell-Williams Team, 1933; and the Granville, Miller & DeLackner, *Q.E.D.*, 1934.

Those are the main facts in the life of Lee Gehlbach, but at every point of his career something out of the ordinary run of human experience happened to him.

◆

● AUGUSTIN PARLA was born in beautiful, romantic Cuba, land of the sugar cane, and the Havana leaf wrapper which the cigar manufacturers wrap around a piece of ordinary rope and sell us here as a five cent perfecto. Cuba also is the land of the black-eyed senorita, and of earnest revolutionists—usually with a black eye apiece.

I've always been happy to think that Cuba owes its independence largely to Teddy Roosevelt, the last American president of the United States, and to a few other Americans who never get much mention. Cuba has more than repaid us for helping to win her independence, for when we lost our own independence to the Anti-Saloon League, Cuba became a haven of refuge and liberty for thirsty Americans.

Augustin Parla, the famous Cuban pilot (he's famous in Cuba, anyhow) spent his childhood in Key West, a place made notorious a century ago by the bold buccaneers of the Spanish Main.

He grew up—as far up as he could get in twelve years—at which age he was taken back to Havana by his family. But at the age of fourteen he and his younger brother ran (or swam) away from home and went to New York. Here he acted as a guide for Latin Americans and finally obtained a post as inspector for the Western Electric Co. Two years later he returned to Havana, and through his knowledge of the English language was able to make a living acting as guide to visiting Americans, some of whom spoke English themselves.

Aviador Cubano Parla

Parla became friendly with General Weaver and became his private secretary, travelling with him on numerous trips to Brazil, and London, Paris, and other European capitals. It's very nice to act as secretary to a General, for if a war breaks out you're safe—you'll never have to dodge when you hear a shot fired. After his return to Cuba, Parla again made his living as an interpreter and guide for Americans, thus becoming a familiar figure in the high spots of that city.

Parla's career in aviation began in 1911, when he met Charles F. Welsh, in Cuba to make exhibition flights for the Curtiss Exhibition Company. Parla made several flights with Welsh and determined to become an air pilot instead of a bar-room pilot, so he collected enough ready cash, in January, 1912, to go to the Curtiss Flying School at Miami, where he learned to fly, receiving his Aero Club License in April, 1912, and returned to Cuba. For a while he was a pilot minus an airplane—like myself—but he was a persistent bird, and finally raised sufficient money, through friends' subscriptions and his own work, to go to Hammondsport and buy a Curtiss seaplane. Having accomplished that, he decided to fly home to Cuba and alight there in grand style. He shipped the plane to Key West, set it up there, and on May 19, 1913, successfully accomplished the flight to Havana. It was his first solo in a seaplane; and Jack Vilas tells us he believes Parla to be the first man to make his first seaplane solo flight on such a dangerous over-water route as Key West-Havana. Parla confidentially admits that he was scared to death on that flight, and I can readily believe it. The Florida Straits are no place to make a seaplane landing; and the motors of 1913 were not absolutely guaranteed to keep running, especially if you only had one of them in your ship. I've flown over those Straits a couple of times myself, and each time the sea was so rough that the odd freighter or two I saw were shipping the seas over the bows. A seaplane down there would have lasted about five minutes before sinking gracefully to Davie Jones' locker.

Now, when Parla got to Havana, he became a national hero—anyone flying in 1913 was a hero. He continued flying and made several notable hops, finally joining the Army in 1914 as a civilian instructor. He was active as a pilot until 1917, when he was sent to Buffalo for an advanced course in the latest types of that period, for further perfection as a flying instructor of the future Cuban military pilots.

(*Continued on page* 102)

AT THE AIRPORTS

WPA Allotments

Construction has begun on 18 airport developments in Okhaloma, Arkansas, Louisiana, Missouri and Texas, according to Moss Patterson, regional airport director for those states. Largest of the projects is at St. Joseph, Mo., where a $100,000 job at the municipal airport is underway. The $77,000 Oklahoma City, Okla., airport project for floodlighting, extension of runways and construction of drainage facilities is another large project. Only other Oklahoma project is at Claremore where the airport is being overhauled.

* * *

Funds for development of a 400-acre landing field near the Glenn L. Martin plant will be sought by Baltimore county from WPA as a result of an agreement reached by County Commissioners and Martin officials. Under terms of the agreement, subject to WPA approval, the county will lease from Martin a tract along the county water front. Cost of the project is placed at $500,000.

* * *

Federal approval of a WPA project to complete Case-Fowler Airport, Milledgeville, Ga., has given added impetus to local efforts to establish a modern airport in the next few months. Georgia Air Developments Corp., has been formed as a non-profit organization to coordinate efforts of all groups and citizens in this and surrounding territory in developing aviation locally.

Milledgeville's field has four runways measuring 3000 × 600 ft. A hangar is to be erected and facilities for servicing ships provided. Efforts will be made to equip the field with lights in the near future.

* * *

According to H. P. Drought, WPA state administrator of Texas, airport projects from nine cities have been tentatively approved. These are located in Austin, Brownwood, Childress, Fort Worth, Fort Stockton, Galveston, Laredo, Temple and Georgetown.

* * *

J. Hall McKinney, district advisor, Bureau of Air Commerce, has recommended to WPA as a preferred project, the construction of a field on city-owned land, two miles from Prescott, Ark. It will have one runway, 500 ft. wide, plus a clearing on each side of 100 ft., and a length of 3,800 to 4,000 ft., with provisions for extension to 4,500 ft.

* * *

Construction work, such as grading, sodding, clearing, paving, marking, etc., is in progress on approximately 50 percent of all airports in Florida at present, and work is progressing on the building of the John Dunglison airport in Venice.

* * *

Improvements costing $2,800,000 have been started at Cleveland municipal airport as a WPA project. Air race grand stands will be moved half mile to the west, and active field space will be extended 440 acres to a total of about 1000 acres. A traffic lane 3600 ft. long will be built.

* * *

Technical approval for thirty-seven additional airports in eight states for development with WPA funds was given by the Bureau of Air Commerce. Final approval must be made by WPA officials and by State administrators. Construction of an emergency landing field, to cost $15,984, at Egg Harbor City, N. J., and an improvement at the air field at Red Bank, to cost $13,875, were approved.

New Companies Organized

Capitalized at $50,000, Northwest Scenic Air Tours, Inc., was recently formed and incorporated in Seattle. It will operate airplanes on scenic trips. Prominent in the incorporating group are Don H. Evans and George W. Murray.

* * *

Olympia Air Transport Corp. was recently incorporated at Olympia, Wash., with capitalization of $10,000 to conduct a complete fixed base business. Incorporators are Howard A. Lincoln, Fred F. Chitty, Paul D. Loudi, W. B. McDonald, and James M. Robinson.

* * *

Aerial Surveys, Inc., of San Antonio has been incorporated by Edgar G. Tobin, M. B. Tobin and H. C. Gross.

Dallas Traffic At Peak

October was the third best month in the history of Love Field, Dallas, in the number of air passengers using the field. During October, 2,432 airline passengers arrived at the airport and 2,388 passengers departed. Traffic showed gains over the same month of 1934, when 1,477 passengers arrived and 1,402 passengers departed. Last August recorded the best business at the airport, 2,775 passengers arriving and 2,897 departing.

New Airports

A section of land has been purchased near Grand Island, Neb., for $25,600 and will be developed immediately as a municipal airport. With a WPA allottment of $252,000 for completion of the port, work has already been started.

* * *

The new municipal field being constructed at Oxford, Miss., will be called Dean Faulkner Memorial Airport when it is completed. Work has started on the field which is five miles from town.

* * *

Hornell, N. Y. taxpayers approved a $7,500 project for the purchase of a 57-acre tract to be used for an airport.

* * *

Shary Municipal Airport, Mission, Tex., was formally dedicated as a feature of the lower Rio Grande Valley's third annual citrus fiesta with Congressman Milton West of Brownsville acting as master of ceremonies.

* * *

A 300 acre site for a municipal airport to serve the towns of Knoxville, Maryville and Alcoa, Tenn. is being negotiated for.

Management Changes

Skyways, Inc., hangar at the Boston Municipal Airport, East Boston, Mass., has been taken over by John Shobe, who will conduct a charter, student, aerial survey, repair, and storage business. Associated with Shobe in the new Shobe Airlines, Inc. are: F. A. Hinchcliffe and M. Vanderslice. The company has the agency for Stinson and Aeronca planes and for Shell and Stanavo products at the field.

* * *

There also has been a change in management of the Sarasota, Fla. airport and improvement of runways, hangars, and installation of mechanical as well as fuel and oil service for local and visiting pilots will be made. In addition, purchase of the hangar by Ben Handler also was announced. Handler plans improvements and a general reconditioning of the hangar and shop. A field office will be erected near the hangar and will contain rest rooms and office. The shop will be under the direction of Nelson Jones and service will be available during daylight hours. Runways and the apron in front of the hangar are to be improved.

Airport Improvements

Twelve floodlights will provide night illumination for the Oklahoma City, Okla. municipal air terminal under an improvement program. Lights will be divided, seven and five in banks.

* * *

Improvements which will make the Omaha, Neb., municipal airport one of the most up-to-date in the country are underway with a WPA allotment of $174,550. The total cost of developing the airport is estimated at $650,000. First allotments are being used to construct a new runway, extend one of the present runways, reconstruct the drainage system and install new lights, including 140 flush-type runway markers. Thirteen will form a ring in the center of the field. Plans also call for 35 boundary marker light cones; a glass control tower atop the administration building; a concrete taxi strip along the sides of the field; enlargement of the loading dock; a paved roadway to the airport; and landscaping the entire area.

Flying Service Moves

Western Oklahoma School of Flying formerly of Elk City, Okla., has moved to Blackwell, Okla., and will conduct business in the future under its new name, Northern Oklahoma Flying Service. The company offers 24-hour service at an airport completely equipped for night operations, with large hangar, office, waiting rooms and rest rooms. Field management and instruction will be in charge of Walter D. Mauk who will be assisted by Duane Huscher. Hangar and shop will be under the supervision of Donald Dodd.

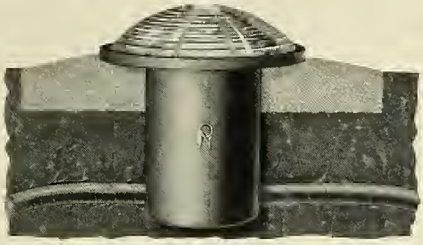
Hangar Fires Burn 15 Planes

Four airplanes were destroyed by fire in a steel hangar at Muller Airport, Revere, Mass. The total damage was estimated at almost $4,000 and the damage to the interior of the hangar at $500.

Another hangar fire caused destruction or damage to eleven airplanes with a loss of $13,200, when fire swept through the large hangar at the Niagara Falls, N. Y., municipal airport. The damage was confined principally to the planes, as the hangar is largely of fireproof construction.

Booth Expands

The Edwin F. Booth Co., airplane dealers and sales agents of Dallas, changed its name to Booth-Henning, Inc., and increased its capital stock from $16,000 to $24,000.



Flat enough to ride over, but . . . The new Pyle-National semi-submerged Runway Marker projects plenty of light for distinct visibility even at low gliding angles. A special prismatic glass cover and correctly designed reflector give wide angle beam for maximum usefulness. The strong, thick glass is of proper radius to permit a wheel or tail skid to pass over without danger of upset or damage to the light. Type MOG has a sturdy cast iron body designed to be set in a concrete oval; is completely weatherproof, yet readily accessible for cleaning or lamp renewal. It takes either 60 watt multiple, or 600-1000 lumen series type lamp. Write for Bulletin 210-B-1 with data on the complete Pyle-National line of airport lighting equipment.

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AIRPORT EQUIPMENT

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When traffic grows and additional radio facilities are indicated, it is not necessary to dispose of AVT-1A. It may be retained, and AVT-8, a linear 100-watt amplifier, mounted upon it. On that may be placed the AVA-3, runway localizer. You then have a complete radio telephone-telegraph and beacon transmitter, offering traffic control, low ceiling approach and landing facilities and public address.

The RCA unit system not only permits you to acquire these facilities in steps, at low cost, but also provides for economical future changes to incorporate modern improvements when desired. We believe this to be the most satisfactory basis for airport equipment. For details, demonstration or purchase, address:

RCA AVT-1A radio telephone traffic control transmitter, the basic instrument in airport equipment. May be used to energize an airport public address system as well as direct traffic.

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Or write direct to AVIATION RADIO SECTION
RCA Manufacturing Company, Inc., Camden, N. J.,
a subsidiary of the Radio Corporation of America

THE AIR SERVICES

Plane Contracts Let

Following a period of suspended aircraft purchasing during which new types of service craft were being tested for final approval, two contracts were awarded to companies whose products were adopted in their final form, although it was generally understood they would receive the awards when the War and Navy Departments would renew the purchasing of equipment. These companies are the Curtiss Aeroplane & Motor Corp., and Northrop Aircraft Corp. The Navy purchased 135 SOC-1 scout-observation planes from the former, while the Army Air Corps bought 100 attack planes from Northrop. The Navy contract amounts to $2,752,705 and calls for completion by July, 1936. The SOC-1 is the result of a design competition held by the Navy, and it incorporates features which represent marked advances in design over airplanes previously manufactured for service with the battleships and cruisers of the Fleet.

Cockpits are enclosed in a new-type cabin enclosure which affords maximum protection to the crew. Internal construction of fuselage and wings is all-metal with fabric for external covering. Designed primarily as a seaplane for catapulting from ships at sea, wheel-type landing gear is also provided for shore training operations. Full automatic wing slots are standard equipment.

The 100 attack planes (and spares) will cost the War Department $2,560,074. Each will be powered by a P. & W. Hornet, will have a maximum speed of 250 m.p.h., cruising speed of 220 m.p.h., and fuel capacity sufficient for 8 hours cruising. Each will carry four .30 cal. fixed machine guns and one flexible gun of the same calibre in the rear cockpit. Designed primarily for operations against ground forces, the planes also can carry twenty small, or four large bombs.

The recent bomber competition resulted in award of contracts to Douglas Aircraft for 90 twin Cyclone-powered bombers and to Boeing Aircraft for 13 four-engined P. & W. powered bombers. Douglas's contract amounts to $6,498,000.

6000-mile Flight Made

Three Massachusetts National Guard planes, commanded by Maj. Clarence E. Hodge, of the 26th Division Aviation, M.N.G., with Adjt. Gen. William I. Rose, and Brig. Gen. Roger Eckfeldt of the 51st Artillery Brigade, as passengers, took off from the Boston Municipal Airport, East Boston, Mass., for a 6000-mile transcontinental flight.

Flying in the plane piloted by Maj. Hodge was Adjt. Gen. Rose. Capt. David R. Stinson, regular instructor to the Massachusetts National Guard, piloted the second ship. With him was Brig. Gen. Eckfeldt. The third plane was flown by Capt. E. Stanely Beck with Tech. Sergt. Lawrence Murray as radio operator.

The group made stops at Buffalo, Omaha, Chicago and Detroit, Salt Lake City via North Platte, and Cheyenne, and flew to San Francisco after a stop at Reno. From San Francisco, they flew south to Los Angeles, and then to Santa Fe, where they attended the National Guard Convention. Later they returned across country to Boston via Amarillo, Tulsa, St. Louis, Dayton, and Buffalo. The cruise required 10 days.

Guardsman Hangar Built

Construction work on a new hangar and administration building for the 154th Observation Squadron, Arkansas National Guard, is well underway with plans calling for completion by January 1. A WPA allotment of approximately $20,000 added to a state allotment made possible the work. The administration building will extend the entire length of the hangar, which will house ten planes.

An allotment of $3,192 also has been approved for demolition of an old hangar at the airport at Little Rock and this work will start soon.

All roads at the field as well as those leading to it are to be paved. $30,014 is available for this work.

Bombers In Fast Flight

Twenty-nine Martin bombers of the 7th Bombardment Group landed at Vero Beach, Fla., after a 21 hour 50 minute flight from March Field, Calif., setting what is believed to be a record for a mass flight. Servicing stops were made at Biggs Field, Fort Bliss, El Paso, Barksdale Field and Maxwell Field before the formation reached Florida. The flight was undertaken to show how quickly GHQ Air Force planes on the West Coast could cross the continent, and also to concentrate the planes in Florida for the All-American Air Maneuvers which were held in Miami.

Permanent Officers Chosen

Under the recent law passed by Congress, Officers of the Line of the Navy could apply for performance of aeronautical engineering only. Accordingly Secretary of the Navy Swanson has approved the recommendations of the Board for selection of these officers and designated eleven line officers and 33 Construction Corps officers to such duty.

Officers of the Construction Corps transferred have the same lineal position and precedence in the line as they would have had if they remained in the line, and none have had their existing relative rank precedence or seniority in the Construction Corps altered by their transfer.

Personnel of VN-17 Squadron at Fairfax Airport, and three of the unit's Helldivers on a formation flight

Naval Reserve Unit Trains

VN-17 Squadron completed two weeks active duty at the Naval Reserve Aviation Base, Fairfax Airport, Kansas City between Dec. 1-14. Squadron activities included tactical, extended and navigational flights, carrier landing practice and gunnery with camera guns being used. The flight equipment consisted of four NY3 Consolidated Trainers and four Curtiss Helldivers.

The squadron functioned as such, each of the 12 officers and 16 enlisted men assuming appropriate duties for the period, and thus gaining experience in administrative, as well as operative phases of Naval operations. Purely technical problems were readily handled for all pilots and all but one enlisted man are employed in the air transport industry. Officers of the squadron are: Lieutenant Commanders D. W. Tomlinson, commanding officer, and W. H. Miller, flight surgeon; Lieutenant D. L. Mesker; Lieutenants (jg) J. E. Harlin, P. T. W. Scott, W. W. Jones, W. F. Peterson, L. W. Olson, M. L. Hoblit, and Ensigns H. C. Hess, E. Z. Boqua and O. P. Haueter.

The Naval Reserve Aviation Base at Fairfax was established last July. Under the supervision of Lieut. F. E. Weld, USNR, commanding officer, and Capt. Peters, USMCR, executive officer, it was put into perfect condition.

Improvements Resumed

Construction of a warming-up and taxi apron at Fort Lewis, Washington, disrupted by freezing weather, has been resumed and the work is rapidly nearing completion. The landing area has been increased 300 percent, the field now containing about 600 acres, more than half of which is available for landing. The balance is being levelled sufficiently to serve as a parking area in the event the field is to be used as a base for maneuvers. Landing area is more than 300 feet across in almost any direction, and is marked by a white concrete circle. Surface is of natural gravel, and while no lighting system has been installed, emergency equipment is satisfactory for pilots familiar with the field.

Westover New Chief

Brigadier General O. D. Westover has been appointed Chief of the Army Air Corps, and was elevated in position to the rank of Major General. Another promotion made by Secretary of War Dern advanced Brigadier General Frank M. Andrews to the rank of Major General. Andrews commands the GHQ Air Force. General Westover has been in charge of the Air Corps since Maj. Gen. B. D. Foulois took a leave of absence prior to his retirement.

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PRIVATE FLYING AND CLUB NEWS

Air Races

The Eighth Annual All-American Air Maneuvers ended a three-day run at Miami with formation flights by the Third Attack Group from Barksdale Field supplying most of the thrills. High winds kept individual race contests down to a minimum, although five were conducted the last day.

R. A. Kling won the Green Trophy with an average speed of 239.9 m.p.h. in his Menasco-powered Keith Reider; Art Chester was second to him, but flying in his Chester Special, reversed the finishing order in the Shell Trophy free-for-all event by averaging 232 m.p.h. to Kling's 213. Ben Stegall won the Cuban Trophy in a Wright-powered Travel Air which averaged 165 m.p.h., and Clarence McArthur took the light plane contest in a Tilbury Flash at 105 m.p.h.

Tex Rankin set what is believed to be a U. S. altitude record by ascending to about 20,000 ft. in his Menasco-powered Ryan S-T. Barograph calibrations have not yet been made.

Commercial plane races brought victory to Larry Cooke in a Monocoupe, and to Douglas Fonda in a Jacobs-powered Beechcraft. Clem Sohn performed his delayed bat-wing parachute jump on each of the three days and Al Williams, Rankin and Capt. Leonard Povey of Cuba gave demonstrations in aerial acrobatics.

* * *

An air show program climaxed an Aviation Progress Week at the Springfield, Ohio municipal airport. Featured was the flying of Lieut. Joe C. Mackey. Also taking part was Major Fred L. Smith, Director of Aeronautics for Ohio.

Ed. Nirmaier and his American-built Sky Louse

Sky Louse Built Here

Eddie Nirmaier of the Crosley Aircraft Co., Sharonville, O., has built and flown a Mignet Pou-du-Ciel, similar to the type now flying in Europe. According to him the plane, which is powered by a 35 h.p. Scorpion engine, takes off at 30 m.p.h., cruises at 65 m.p.h., and has a top speed of 80 m.p.h.

There is no rudder bar, the stick controlling the rudder and twin wheels, the latter being attached directly to the rudder. The stick also controls the incidence of the main or front wing. The rear wing is stationary, and there are no ailerons, but a large dihedral on the front wing. Provision is made for one person, the plane measuring 19.5 ft. in span; and 11 ft. in overall length.

Al Williams Performs

More than 100,000 residents of three southern cities have thus far attended the first three of a series of one-man air shows, given by Major Alford J. Williams in co-operation with Eastern Air Lines. This series is the outgrowth of a discussion between Major Williams and Capt. Eddie Rickenbacker, general manager of Eastern Air Lines, both of whom decided that only by visiting their local airport, and seeing active aviation transport and field operations, could the general public be brought to a realization of aviation's progress.

As a result, Richmond, Va., New Orleans, La., and Atlanta, Ga., have thus far been the scenes of Major Williams' display of aerobatics in his "Gulfhawk".

Personnel Notes

Members of the Buffalo, N. Y. Chamber of Commerce Aeronautics committee, named recently by Reginald V. Williams, newly-appointed chairman, are: Peter T. Allen, Lawrence D. Bell, Adrian Block, E. Harold Brayer, Merrill J. Campbell, Lewis S. Castle, Norman P. Clement, William J. Conners, Jr., Franklin D. Davis, Harley F. Drollinger, J. Allen Gardiner, W. Hamilton Gardner, William T. Jebb, Jr., G. S. Lapp, E. L. Townsend, George Waite, C. L. Whitehead, Jr., Ray P. Whitman.

ACTIVITIES AT THE SCHOOLS

New Courses

A special course in military design has been added to the curriculum of the engineering school of the Curtiss-Wright Technical Institute of Aeronautics. Given twice weekly by David Moseley, it is open only to advanced students. The course consists of 100 hours of instruction and requires six months to complete. Each period of instruction consumes two hours; work includes instruction in all-metal monocoque fuselage and wing construction as well as in other modern metal construction design. It is limited to military craft only.

The Institute's engineering school will soon have its own text on Practical Airplane Design. Although several engineering text books are used, lack of published material on certain phases of practical engineering made it necessary to devote considerable time to lecture. These lectures are now being compiled into a text and time formerly devoted to lecture will be utilized for problems and quizzes.

* * *

The Massachusetts Department of Education is giving an extension course in aeronautics at M.I.T., with George P. Bently as instructor. Offered once a week for sixteen weeks, the course includes ground school preliminaries to flight and will provide instruction in structures and rigging.

* * *

A course in aeronautical theory and practice will be given in the second semester at Middlebury College, Vt., with William E. Hinton instructing. Flight theory, simplified aerodynamics, airplane engines, meteorology, navigation, propeller design and air transportation are offered. Actual flying will be conducted under the auspices of the student flying club.

* * *

The hangar previously operated by Interstate Airways at Hartford, Conn., has been taken over by H. B. Wetherell, manager and chief instructor of the Hartford Flying Service to conduct a flying school. Training ships are a Warner Fleet, Challenger Robin, and Kinner American Eagle.

Equipment Expanded

A completely equipped engine testing stand for the engine maintenance and overhaul department of Parks Air College has been constructed. Housed in a masonry and steel structure, it measures 15 × 15 × 11 ft. A fourth dormitory, accommodating 17 persons has also been built, as well as a new wind tunnel for the aeronautical engineering school. The tunnel is the open-throat, return flue type.

* * *

New equipment recently installed at Lincoln Airplane and Flying School includes a Wasp, Cyclone, Whirlwind, Kinner and a Packard Diesel engine.

* * *

New radio equipment, Wasp and Cyclone engines have been added at the Spartan School.

Enrollments

There were 111 new enrollments and 17 registrations for additional work by old students at Parks Air College, bringing total resident enrollment to more than 250. Ninety-six are taking the Master Mechanics Flight Course; 80 Aeronautical Engineering; and 40 are in the Executive Transport Pilot division.

* * *

The Ryan School of Aeronautics reports 12 new students.

Open throat tunnel built at Parks Air College

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AIRLINES AND AIR TRAVEL

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New Air Travel Policy

Beginning January 1, six of the largest casualty insurance companies in the United States, Aetna Casualty and Surety, Century Indemnity, Hartford Accident and Indemnity, Maryland Casualty, New Amsterdam Casualty and United States Fidelity and Guaranty Co., will underwrite a new form of insurance for airline commercial travelers, which will compare favorably in cost with other travel insurance. Termed "airsurance" it will be an employer's voluntary contractual liability policy under which it will be possible for him to obtain up to $10,000 insurance for each employee named in the policy, at a rate of $1.00 per $1,000 per year. The minimum premium for any one employer will be $50.00, covering five or more designated persons. This new policy was developed at the request of large corporations which have sought such a form of insurance for their executives and other employees to encourage them to take advantage of the time saved by air travel.

This insurance is a contract of indemnity agreeing to reimburse an insured employer for a stated amount in case of death or injury to an executive or employee caused by accident on any recognized airline. It permits payment by the employer to any named employee in the event of injury. In the event of death, payment may be made to a relative or to any person appearing to the insured to be entitled to such payment.

Officials of the United States Aviation Insurance Underwriters, Inc., and of Eastern Air Lines, Transcontinental and Western Air, United Airlines, American Airways, Pan American Airways, Pennsylvania Airlines, Northwest Airways and National Parks Airways, approved of the new airsurance.

Hawaiian Air Traffic Heavy

Augmented facilities for air travel in Hawaii are a response to the increased demand for this type of transportation from island to island. Inter-Island Airways has taken delivery of the first two Sikorsky S-43 amphibions, the second to follow shortly. These planes, powered by two P. & W. Hornet engines, have a cruising speed of 185 m.p.h., and a maximum speed of 200.

Air travel in Hawaii has grown since November, 1929 when Inter-Island inaugurated service. Since then, 60,000 passengers have been carried and 1,500,000 miles flown. Air traffic for the first nine months of 1935 showed 10,071 passengers; the first nine months of the preceding year showed 7,757 and passengers totaled 4,599 for the corresponding period in 1933.

Inter-Island maintains daily (except Sunday) service between Honolulu and the islands of Hawaii, Maui, Kauai, Molokai and Lanai, and recently began booking transportation on recognized airlines anywhere in the world.

30 New Planes For Airline

Delivery of Douglas DC-3s will climax the new equipment program launched by American Airlines, Inc. in 1934 since when 28 planes have been added to its fleet at a cost of more than $2,300,000, including extra engines and radio.

Orders for new equipment scheduled for delivery early this year exceed $2,260,000, including the 15 Douglas DC-3 sleeper transports, and 15 Stinson Model "A" trimotored transports for service between intermediate cities.

1936 plans include inauguration of seaplane service between New York and Boston in the spring. Company engineers report that operations can be undertaken at convenient water-front locations in both cities and that elapsed time from water-front to water-front will be less than 90 minutes, making possible a saving of more than an hour.

New Equipment

Hamilton Standard constant speed controllable-pitch propellers are being installed on Northwest Airlines' Lockheed *Electras*, at a total expenditure of about $15,000. Additional speed, better take-off, rate of climb and increased cruising speed are now expected. Northwest also purchased a complete frequency monitor, an apparatus for measuring operating frequencies of its radio units, both in aircraft and on the ground. The unit will be installed in the Billings, Mont., station.

* * *

Fifty of United Air Lines' Boeing transports are now equipped with the constant speed propeller and automatic carburetor control. Added dependability, speed and economy of operation result from the use of the new units, regarded as outstanding developments during 1935. United has obtained more efficient performance during climbs, descents and at cruising speed since installing the new devices.

70,924 Passengers

October, 1935 traffic was greater by 21,815 than traffic during the same month the previous year, according to the Bureau of Air Commerce which reports 24 companies operating during that month carried 70,924 passengers, flew 5,288,180 miles, carried 488,019 pounds of express and flew 28,787,563 passenger miles. More than 51 percent of available seating capacity during October, 1935 was utilized by paying passengers.

* * *

American Airlines, Inc. carried 153,056 of the revenue passengers who flew during the first ten months of 1935. This figure represents a gain of 80.16 percent over the same period a year ago, constituting, according to President C. R. Smith, the largest gain any major company ever reported. Each of the previous 14 months has seen the company carry more passengers than any comparable month of its history. The 17,854 passengers carried in October, 1935 represents a 40 percent gain over October, 1934.

* * *

President Temple Bowen of Bowen Air Lines also reports better traffic by 74 percent for his company for the past six months, October being one of the best in the total number of passengers carried since the company started in 1930. In comparison with the corresponding month of 1934, there were 78 percent more passengers carried in October, 1935, he said.

* * *

Delta Air Lines cut flying time between Dallas and Atlanta more than 20 percent when its new fleet of Lockheed *Electras* went into service January 1.

New Airline Organized

Marine Airlines, Inc., announced plans for amphibion service with Sikorsky S-43's between New York and Boston, flights to begin this spring on an eight round-trip schedule each day. Operations will concentrate around seaplane bases on the water front centers of both cities. Flying time is to be less than 90 minutes, with the route being over Long Island Sound.

Officers of Marine Airlines, Inc., are James M. Eaton, president; W. Sanger Green, vice-president in charge of operations; and F. William Zelcer, vice-president in charge of traffic.

Fare Reductions

Air-Scrip, good for transportation on virtually every airline in the United States, carrying a 15 percent reduction under established one way fares and 5 percent under round-trip fares, and permitting free interchange between all airlines and circuitous routings went into effect January 1.

The new Air-Scrip plan is available in two forms—travel cards and individual scrip books. Travel cards will be issued against a minimum deposit of $425, entitling the holder to $500 worth of air transportation, obviating the necessity of cash outlay in procuring tickets over the entire airline network, and enabling the traveler to go on an extended trip without carrying personal funds for transportation expenses.

Scrip books also will be issued in units of $500 each, procurable at $425. These will be honored at all airline ticket offices and the amount of transportation used will be taken out of the book when tickets are issued.

Plans for enactment of the program were completed at a meeting of the air transport operators in Chicago. Lines represented included: American Airlines, United Air Lines, Transcontinental & Western Air, Eastern Air Lines, Northwest Airlines, Pennsylvania Airlines, Central Airlines, Central Vermont Airways, Delta Airlines, Chicago & Southern Airlines, Braniff Airways, Wyoming Air Service, National Parks Airways, Western Air Express and Hanford Airlines.

* * *

New tariffs for winter air travel, some lower and many within a few cents of standard rail and pullman rates, have been put into effect between Washington, Pittsburgh, Akron, Cleveland and Detroit by Pennsylvania Airlines and Transport Co.

Personnel Changes

United Air Lines, Inc. announced the appointment of Bob Neff as its press representative for the New York district, succeeding Frank Curtis who resigned. Seeley Hall became assistant to D. B. Coyler, vice-president in charge of operations, and O. C. Richerson took the position of Pacific Northwest Division Superintendent formerly held by Hall.

* * *

William Gange, traffic representative for Braniff Airways in Oklahoma City has resigned his position.

* * *

W. E. Wilkerson has been made district sales manager for American Airlines in Oklahoma City.

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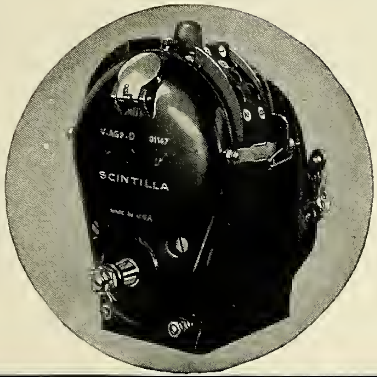

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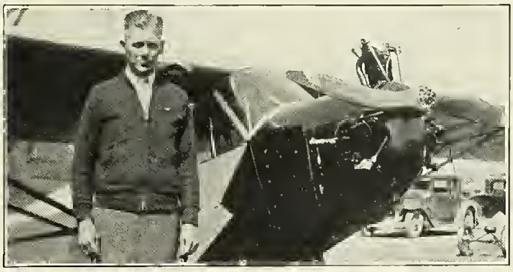

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THE INDUSTRY IN GENERAL

October Exports $996,903

Foreign purchasers of American aeronautical products spent $996,903 during the month of October, 1935, for 30 planes, 52 engines, in addition to parachutes, and other aircraft parts and accessories. Sales of aircraft were worth $286,042; engines $255,076; parachutes, $7,191; and parts and accessories, $448,594. Fifty-two foreign countries and two possessions of the U. S. were represented in the number who did business with us during that month.

Brazilian purchases of aircraft resulted in the sale of 22 craft valued at $166,157, the largest number of planes sold in one country during the month. Russian purchase of one plane netted $77,885, and the three planes sold in Ecuador brought $28,600. Other countries importing American aircraft included Norway, Mexico, Liberia and the Philippine Islands, each of which took one plane.

Engine sales in Italy accounted for 21 units, worth $179,540; Brazil imported four at $16,914, and Trinidad & Tobago five at $15,000. Other engines were sold to purchasers in Japan (3); Union of South Africa, Argentina, Mexico, Canada, Netherlands and Latvia (2 each) and Russia, Panama, Cuba, China, Netherland India and Hong Kong (1 each).

Spain purchased parachutes valued at $5,500, and the largest transaction for parts and accessories was consummated with Russian purchasers who took $133,796 worth.

October exports brought the ten-month total to $12,211,902.

Crusader on Tour

The American Gyro *Crusader* is now on a country wide demonstration tour which will carry it to Kansas City and St. Louis, Mo., Nashville, Tenn.; Jacksonville and Miami, Fla.; and New York City; with various smaller towns tentatively scheduled for a stop before the plane is returned for exhibit at the Pacific-National Aircraft show in Los Angeles.

The tour represents a culmination of ten months of flight testing to establish the characteristics and performance of this type of plane. The present plane is not equipped with the retractable landing gear and controllable pitch propellers which will be fitted on production models. Capable of carrying four persons in its closed cabin of tear drop form, the *Crusader* is powered with two Menasco *Pirate* C4S supercharged four-cylinder engines.

The company has announced plans for the early construction of a larger and faster six-place job of the same general design as the present ship but to be powered with two of the newest Menasco six-cylinder engines, known as the Buccaneer C6S-4 of 250 h.p. each. Negotiations also are being conducted looking toward the location of an aircraft factory in Southern California for the production of the planes.

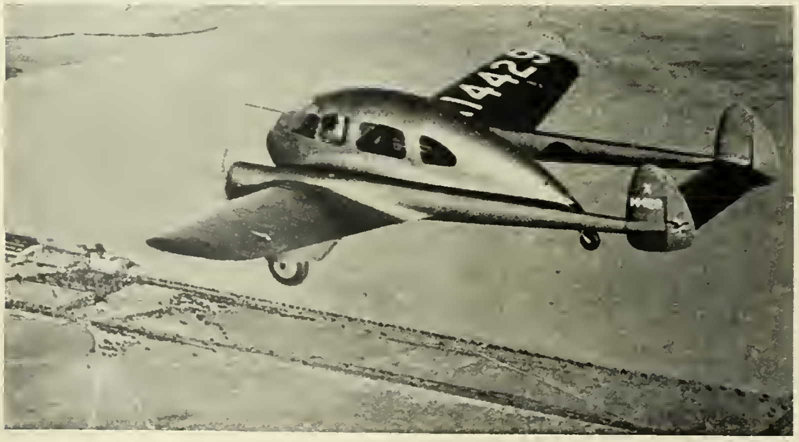
Engine Corrosion Overcome

Cold corrosion which attacks idle aircraft engines in the tropics, has been overcome by research, it is reported by Dr. George Calingaert, director of the Detroit chemical laboratories of the Ethyl Gasoline Corp. After tests carried out over months in a specially constructed tropical room, a slushing compound which defies rusting in a humidity of 90% and a temperature of 100°F was developed.

The compound, a sprayable brown oil which forms a jelly-like film, affords protection to the engines. Before any tests on engines were started, more than 500 steel plate samples, both polished and unpolished, were separately treated by three methods to cause them to rust in damp air. Protection experiments with 80 chemical compounds in numerous proportions and mixtures followed. The scope of the investigation was then enlarged to include protection of actual automobile engines and later of aircraft engine cylinders. The new compound is composed of triethanolamine, (5-6%); aluminum stearate (10%); butanol, (10-12%); and lard oil.

Suncook Adds to Line

A new width fabric has been added to Suncook Mills regular line of Grade A Material which is manufactured in accordance with Army and Navy specifications. For a number of years, Grade A fabric was manufactured and sold in the 36" width only. Some years ago *Flightex* was introduced in 42", 60" and 69" widths in order to keep up with the trend toward larger aircraft. Suncook Mills is now bringing out a 90" fabric, a new width particularly adaptable for fuselage covering, where the customary unsightly seam may be eliminated. This new width also allows economical cutting on the tail surfaces of numerous planes.



The Menasco powered American Gyro Crusader

Plane Production Gains

Manufacture of commercial aircraft to Sept. 30, showed 1935 better than the similar period of the preceding year by 156 units. 763 planes were produced, having a total value of $7,397,732, slightly more than 16% better than the value of the 607 planes manufactured during the first nine months of 1934.

Engines produced for commercial use totaled 1366, valued at $4,546,502, considerably less than the 1600, worth $7,773,935 produced during the first three quarters of 1934. Further output losses were evidenced in military aircraft and aircraft engine production, although the value of the former exceeded that in the similar period in 1934.

Transport planes produced, the Aeronautical Chamber of Commerce reports, represented 62.8% in value and 11.5% in units of the total commercial production during the period under consideration.

Plane Sales

Aircraft Industries, Grand Central Air Terminal, reports the sale of a new Stinson Reliant de luxe model, to W. R. Condon. Also sold was a Wasp-powered Lockheed Orion to J. B. Messick of Pasadena and a J-5 Stearman to John Brander of Marysville, California.

* * *

The first of the Jacobs-powered Fairchild "45" series has been delivered to Superior Oil Company, Houston, Texas. This plane is a five-place low-wing monoplane, details of which were fully described in the September, 1935, issue of Aero Digest.

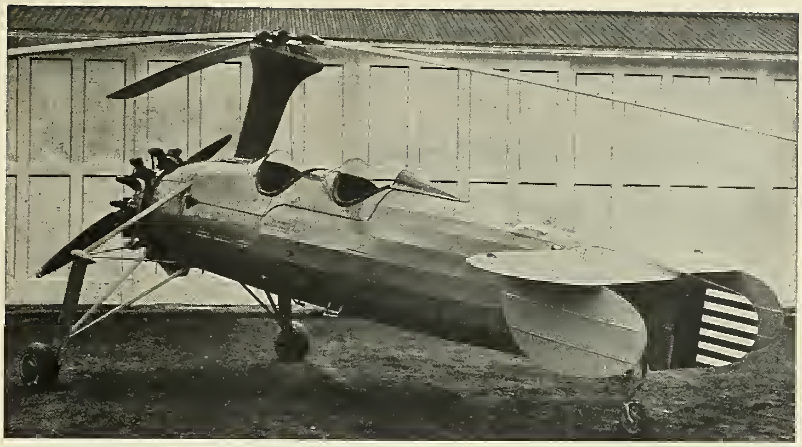
Fairchild also delivered a specially constructed "22" to the Navy department, which in turn delivered it to the NACA at Langley Field, Va., for use as a flight laboratory for studying and measuring aerodynamic characteristics of experimental wings in actual flight.

* * *

Twenty-three Taylor Cubs were delivered during October, according to M. A. Mabb of the sales department. Five were delivered to purchasers in New York; three each in California and Michigan; two each in Ohio and Indiana, and one each in Vermont, Arizona, District of Columbia, Oklahoma and Georgia.

* * *

Richard H. Depew, Jr., and Beckwith Havens, Fairchild distributors for the Northeast, with headquarters at Roosevelt Field, sold a Fairchild "24" to Richard D. Clemson of Middletown, N. Y., and another to J. J. Ryan of New York.



Two-place Jacobs 225 powered Kellett autogiro for the U. S. Army Air Corps

Deliveries Resumed

Officials of the Glenn L. Martin Co. have announced that their contract with the United States government for the manufacture of 103 bombing planes would be completed by August. Deliveries are now being made at the rate of three per week. Four of the planes already are at Langley Field. These bombers had no connection with the recent competitive tests of Martin, Douglas and Boeing planes at Dayton, Ohio, for government contracts. The *Hawaiian Clipper,* Martin's third flying boat for trans-Pacific service, left the Middle River plant for Miami on the first leg of its shake down cruise to the West Coast to join the two Clippers already there for air mail and passenger service between San Francisco and Manila, P. I. This ship is the last of the three built for the Pacific fleet of the Pan American Airways System at a cost of approximately $1,000,000. It is identical with the *China Clipper,* which completed the first round-trip over the Pacific Ocean, and the *Philippine Clipper.*

Martin engineers are now working on plans for faster and more economical planes which would be suitable for the United States-European service.

Flight Charts Issued

Two new aeronautical charts, designed especially for pilots who cover long distances at high speeds with few intermediate stops, have been issued by the Bureau of Air Commerce.

Printed on a scale of 1 to 1,000,000 as compared with the 1 to 500,000 scale of the Bureau's Sectional Aeronautical Charts, each of the Regional Aeronautical Charts covers an area corresponding to that in six sectional charts. With the difference in scale, however, the size of the sheet of the regional chart is only a little larger than that of the sectional chart.

The regional charts are in two editions, one for day flying showing geographical features and aids to air navigation, and another for day and night flying, with a special chart of radio stations and aeronautical lights on the reverse side of the sheet.

One of the charts represents an oblong of territory with Madison, Wis., in the northwest corner, Toronto, Canada, in the northeast, Charlottesville, Va., in the southeast, and St. Louis, Mo., in the southwest. The other shows an area along the Atlantic Coast, extending inland to Lake Ontario in the northwest and Washington, D. C., in the southwest.

Business Reports

An affiliation of the businesses of Toledo Steel Products Co., Toledo, Ohio, and Thompson Products, Inc., Cleveland, Ohio, has been announced. Policies of both companies, which are to be continued as separate entities in manufacturing, selling and distributing, will continue as in the past. Distribution through reputable outlets, and manufacturers, will be the sole aim.

* * *

Sales of the Waco Aircraft Co., for the nine-month period ended October 1, were $820,537, or within $75,000 of last year's total. Third quarter profits were $43,000 compared to a net loss of $65,000 in the first two quarters.

Approved Type Certificates

Waco Aircraft Co., received approved type certificate 586 covering its model YPF, a three-place, open or closed land biplane powered by a 225 h.p. Jacobs engine.

* * *

The Hornet S9E of the Pratt & Whitney Aircraft Corp., received engine ATC 152. It is a nine cylinder radial, air-cooled engine rated 650 h.p. at 2050 r.p.m. at 3000 ft.

* * *

Approved type certificate 587 has been issued by the Bureau of Air Commerce to the Fairchild high speed amphibion, a large and fast single-engined transport. Six of these aircraft have been ordered by Pan American Airways for use on river routes of its international airline system and one has been delivered to Richard Archbold of New York City.

45-Place Transport

Construction of a transport plane designed to carry forty passengers and a crew of five will be begun by the Douglas Aircraft Company, Inc. The mock-up is nearing completion under the supervision of Arthur S. Raymond, chief engineer. More than twice the size of the DC-2 the new plane will be known as the DC-4. Sleeping accommodations will be provided for twenty passengers. The crew will consist of pilot, copilot, radio operator, stewardess and porter. The DC-4 will weigh in excess of 50,000 lbs. Wing span will be 135 ft., overall length 95 ft. Four engines will develop more than 1,000 h.p. each, giving a cruising speed of 180 m.p.h. and a top speed of 200 m.p.h.

Digest of Recent Events

Fly 17,879 Feet Over Mt. Orizaba

A record for commercial and military planes was set when a Lockheed Electra carrying four passengers and two pilots flew over the crater summit of Mexico's Mt. Orizaba, 17,879 feet, the third highest peak in North America. The plane, on a company survey flight from Minatitlan, Vera Cruz State, to Mexico City, reached an altitude of 18,350 feet. Orizaba is exceeded in height only by Mt. McKinley and Mt. Logan on this Continent. NOV. 29

Clipper Completes Circuit of Pacific

The *China Clipper* completed the first regularly scheduled round-trip flight between Alameda, Calif., and Manila when she landed in San Francisco Bay 17 hours 1 minute out of Honolulu and 122 hours 42 minutes (flying time) since the take-off at Alameda, and well under the scheduled 130 hours. The inbound flight was 7 hours 5 minutes less than scheduled, with helping winds at 10,000 ft., increasing the speed of the plane. Capt. Edwin C. Musick commanded the plane on her inaugural flight which started on November 22. DEC. 6

King Sets Two Light Plane Records

Two world records for small seaplanes were established in Miami, Fla., by Ben King, of Washington, who first flew 70.48 miles an hour over a 500-kilometer closed course, creating a record for seaplanes weighing less than 551 pounds. No record had existed for this class. Later he flew the same Aeronca over a 100-kilometer course at 80.931 miles an hour, breaking the record of 76.293 miles an hour. DEC. 11

Rankin Sets New U. S. Altitude Mark

An American altitude record for planes weighing less than 1,235 pounds was claimed by Tex Rankin who believed he bettered 20,000 feet. Rankin whose barograph must be calibrated at Washington before he will know whether he bettered the existing national record of 18,564 feet, established by Willford G. Moore in 1929, flew in a Menasco-powered Ryan S-T monoplane. DEC. 14

Philippine Clipper Makes Pacific Flight

While head winds encountered most of the way from Alameda, Calif., retarded its arrival at Honolulu, the *Philippine Clipper* negotiated the round-trip to the Philippine Islands and return in 118 hrs. 56 min. This is 4 hours less than was taken by the *China Clipper.* The *Philippine Clipper,* commanded by Capt. J. H. Tilton and carrying a crew of nine, took 20 hrs. 14 min. for the Alameda-Honolulu leg. DEC. 26

Aircraft Show Reservations

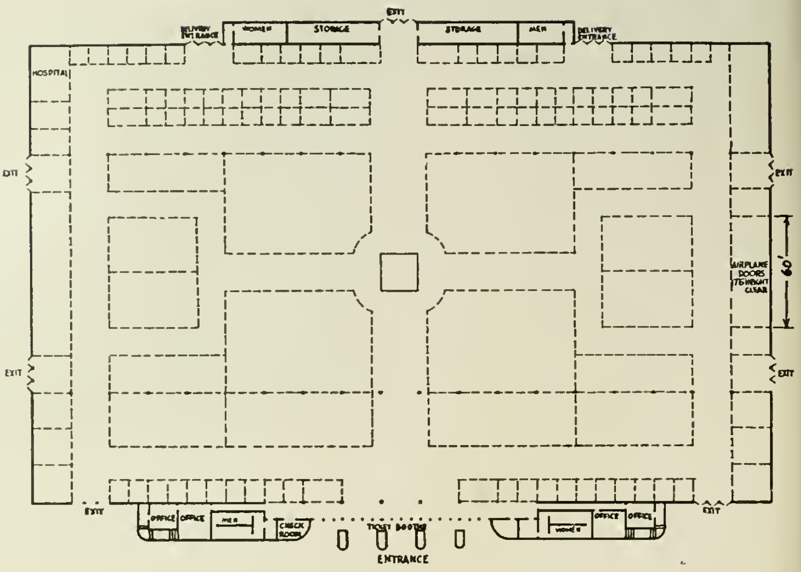
Aircraft exhibited at the National Pacific Aircraft & Boat Show in the Pan Pacific Auditorium from Feb. 1 to 9 inclusive will be housed in a modernistic structure measuring 110,000 sq. ft., of which about 250 × 385 ft. is available for the exhibitions.

Promise of participation by aircraft manufacturers and operators assures representation of leading aeronautical organizations of the country. In the list of participants are Douglas Aircraft Co., which will display the new American Airlines' sleeper transport. Lockheed will present one of its club Electras and United Air Services will show the Lockheed Vega in which Amelia Earhart Putnam made her solo flight across the Pacific.

Cliff Henderson, managing director, already has reservations for exhibit space from Kinner, Northrop, Waco, Stinson, Ryan and Fairchild factories and distributors. Private and commercial craft also will be represented. Wright Aeronautical Corp., and Pratt & Whitney Aircraft Co. have reserved space as have Menasco Motors, Inc., and Continental Motors.

Other reservations include Bendix Aviation Corp., Air Associates, General Tire and Rubber Co., Goodyear Tire and Rubber Co., Standard Oil Co., Shell Oil Company of California, Pacific Airmotive Corp., American Airlines, Kollsman Instrument Co., Aero Digest, Sportsman Pilot Magazines, and many of California's airline terminals and airports.

Working in co-operation with the Show committee many aviation groups plan conferences and conventions during the Exposition. An inaugural ball, sponsored by the Southern California chapter of the 99-ers will be given January 31 with pilots, executives and technicians invited. A technical session of the Society of Automotive Engineers has been scheduled for the week of the show and on Feb. 7 leaders of all branches of aviation will meet at a banquet sponsored by the Los Angeles Chamber of Commerce.



Floor plan of the Pan Pacific Auditorium for the February Aircraft Show

Stinson Anniversary

Stinson Aircraft Corp. celebrated the tenth anniversary of its existence this month, the feature of which was the christening of the 1936 Stinson *Reliant* by Mrs. Eddie A. Stinson and a group of ten-year men who helped build and test fly the first Stinson airplane in January, 1926.

The corporation was founded in Detroit in 1926 by the late Edward A. Stinson, William A. Mara, and a group of Detroit capitalists. It was acquired in 1929 by the Cord interests and lately was merged with Lycoming Aviation Engines, Lycoming-Smith Controllable Propellers and Vultee, under the name of Aviation Manufacturing Corp., and thus becomes a subsidiary of the stockholders of the Aviation Corp.

Stinson has produced more than 1000 single engined and tri-motored airplanes valued at more than $10,000,000 and has confined its activities strictly to commercial planes.

Post Plant to Move

Proposal of the Wiley Post Aircraft Corp. of Oklahoma City, Okla., to construct a hangar and factory at the Oklahoma City municipal airport has been accepted by the city council with the understanding that construction on the $30,000 project will start soon. The company may operate a school, factory and repair shop and storage hangar.

Personnel Changes

The Aeronautical Chamber of Commerce of America, Inc., elected Leighton W. Rogers president. He succeeds Thomas A. Morgan who resigned the office which he held for almost three years. Rogers has served as executive vice-president of the Chamber since June, 1933.

* * *

Raoul J. Hoffman is now located at 317 S. Wabash St., Wabash, Ind., from where he is marketing new calculators and slide-rules for the Lawrence Engineering Service.

* * *

Walter E. Lees, formerly test pilot and aeronautical service engineer for Packard Motor Car Co., has joined the staff of Scintilla Magneto Co., Inc. Lees, who will specialize in the sale of aircraft spark plugs and radio shield harness, is a pilot of long standing, being a member of the Early Birds, and is well known for his work in the development of the Packard Diesel engine.

* * *

Carl S. Baehr, who has been in charge of the Standard Oil Company of New Jersey hangar at Newark Airport since 1930, has been transferred to Quiriquire, Venezuela, where he will be in charge of the maintenance of an affiliated company's airplanes.

* * *

Appointment of Helen Richey as an air marking pilot for the Bureau of Air Commerce, was announced. Her duties will consist of assisting municipalities in arranging for the marking of roof tops with signs to aid pilots in flight.

* * *

Burdette S. Wright has been appointed vice-president in charge of the Curtiss Aeroplane & Motor Corp., Buffalo, following the resignation of Ralph S. Damon who joined American Airlines as vice-president of operations.

Mapping Contract

An aerial survey of Dutchess County, New York, covering more than 800 square miles of territory, will be undertaken by Fairchild Aerial Surveys of New York City. Fairchild K-3 mapping cameras and Fairchild 71 photoplanes will be used.

The survey is being undertaken for the Dutchess County Planning Board, Poughkeepsie, N. Y. The aerial photographs and the maps will be used in county planning and will be available for use of individual towns in local work, such as tax adjustments, and by private engineering concerns, public utilities and the general public.

Coming Events

A meeting of the north-central regional members of the State Aviation Officials will be held at the Plains Hotel, Cheyenne, Wyo. Jan. 12-14

•

An Airport Equipment Exposition will be held in conjunction with Aerodrome Owners Association Convention and Conference, London, England. Jan. 30-31

•

The National Pacific Aircraft and Boat Show will be held at the Los Angeles Pan-Pacific Auditorium under the management of Cliff and Phil Henderson. Feb. 1-9

•

Closing date for entries in the Seventh Annual W. E. Boeing Scholarships, Boeing School of Aeronautics, Oakland, Calif. Mar. 15, 1936

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 15-June 1, 1936

•

1936 National Air Races will again be held at Cleveland Municipal Airport. Cliff Henderson, managing director. Sept. 3-6, 1936

•

A 7060-mile round-trip speed and handicap race between Paris and Saigon, and sponsored by the Aero Club of France, will start from an airport near Paris. Oct. 1936

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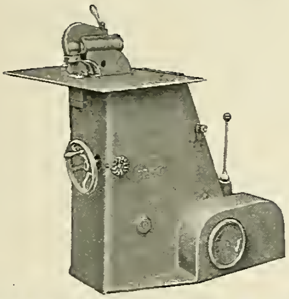

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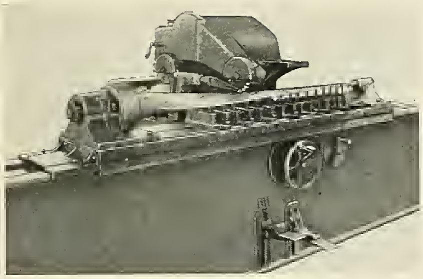

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FOREIGN NEWS IN BRIEF

●

Australasia

Wing-Commander L. J. Wackett has designed and constructed the largest plane yet built in Australia. A successor to the *Codock*, the new plane is named the *Gannet*, and accommodates seven passengers. The first job has been test flown and showed a maximum speed of 160 m.p.h., with a cruising speed of 135 m.p.h. It is a high-wing monoplane with two Gipsy Six engines mounted atop the wing. Another *Gannet* is almost completed, and construction on a third has begun.

Airlines of Australia has been registered with a capital of £1,000,000. Among the directors is Lord Semphill, and G. A. Robinson of New England Airways.

The New England service to Townsville has been extended to Cairns, an additional mileage of 200, making it possible direct air to fly direct from Sydney to Cairns.

Delivery of the first all-metal Moth built at the Maribynong factory has been completed. It is the first of six ordered for training purposes at Point Cooke, and it is possible that an order will be placed for fighting planes in the near future.

Officials of the Federal Works Department and the Civil Aviation Department have devised a new plan for the illumination of the airports at Essendon, Adelaide, Brisbane, Sydney and Darwin, the cost of the work being £40,000. Boundaries will be marked with orange lights at intervals of 100 yards, with red lights for obstacles, and green lights for runways.

A series of experimental round-trip flights between Penang and Hong Kong were inaugurated with the departure of an Imperial Airways plane which followed a course involving two sea crossings. The first over-water section, between Penang and Saigon, French Indo-China, is 400 miles in length and the second, between Tourane and Hong Kong, is 600 miles long.

With funds amounting to $328,467 available for use during the next 2 years, the work of improving the Karachi, India, airport is under way. The landing area will be lengthened 900 ft. New hangars will be erected and the administration building to be built will house, in addition to the airport offices, the meteorological, radio, mail, customs, police and health offices. Extensions and improvements are expected to make the airport the best in the East.

Air mail and express service from Fukuoka southward to Taihoku, Taiwan (Formosa) was inaugurated with Fokker F7 3M planes. Four American transports are expected to be purchased when passenger service is inaugurated April 1. The 1000-mile route follows a chain of islands. A stop is made in the present weekly service at Naha, 435 miles north of Taihoku. The budget of the Taiwan Government General for the fiscal year ending March 31, 1936, provides $51,732 as a subsidy for an air service between Taiwan and Japan.

Penang has been substituted for Alor Star as a scheduled stop for Imperial Airways. Considerable work has been done on the airport there recently to bring it to the required condition for the use of heavy aircraft. There are two runways; one is 300 yards wide and 950 yards long. A 60-yard asphalt-macadam strip runs down the center and is flanked by 70-yard grass strips, with macadamized turning and parking areas at each end. The other strip has a grass surface and measures 200 yards wide by 800 yards long. Night landing equipment will be installed.

Canada

November gross income of the Vancouver port exceeded that of October by $179.85. Compared with November of 1934, revenue showed an improvement of $185.26. Thirty aircraft of all types make the airport their base of operations. Seventeen use the landplane hangar, while nine occupy the seaplane hangar. Four Moths of the Non-Permanent Air Force occupy the annex to the landplane hangar. Construction began last month on a new building at the Vancouver airport for a repair and service depot for Coates Ltd. The building is to be of frame and stucco construction and will comprise office, machine shop, welding and other shops, as well as a storage hangar 40 × 50 ft. Construction is to be completed early this year.

Improved schedules eastbound from Seattle by Northwest Airlines have provided a two-hour reduction in the air-rail journey to Toronto. Leaving Vancouver by United Air Lines to Seattle at 2 p. m., one day, a passenger transferring to Northwest's Lockheed Electras flies east via Chicago and Detroit to entrain for Toronto, arriving there at 8 p. m. the following day.

Austin Crate of the Toronto Flying Club was presented recently with the Alcock-Brown trophy, an award made annually to the pilot who flies most hours on the anniversary in June of the first trans-Atlantic flight. Other Toronto Flying Club news includes the appointment of S. Chriswell, formerly of the Ottawa Car Co., as chief engineer; the club's field is being used by the new Inter-City Airways operating between Toronto, Detroit, London and Buffalo; and the exhibition of the organization's new deHavilland Hornet *Moth* at the Canadian automobile show at Toronto.

Five Royal Canadian Air Force bombing squadrons have been authorized for the Non-Permanent Air Force; two are at Montreal and one each at Toronto, Vancouver, and Hamilton. With the officer personnel for these units being selected from individuals who hold certain flying qualifications and airmen who are qualified for employment in an air force, the units undergo air force training of a nature appropriate to bombing squadrons.

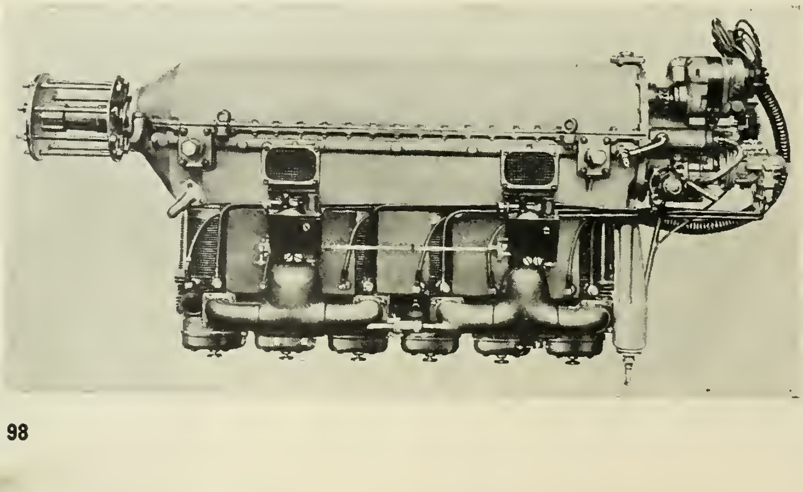
Seven new airports in Northern Ontario are now available for landing though buildings must yet be constructed and equipment installed, according to G. L. McGee of the Department of National Defence. Planes can now land safely at Reay, Emsdale, South River, Diver, Gillies Depot, Porquis Junction and Kapuskasing. Fields at Tudhope and Round Lake are not far enough advanced to permit landings. Work on many of the projects has been suspended for the winter.

Denmark

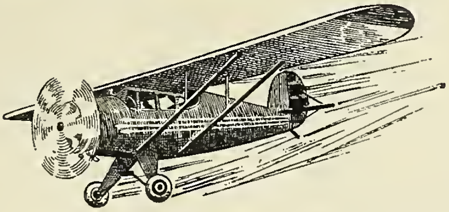
A complete lighting installation will be finished in the near future at the Kastrup, Copenhagen airport. There are 5 floodlights of 2,000,000 c.p. each placed around the periphery of the airport on towers which are easily seen during the day and are provided with obstruction lights at night. Each light has a light sector spanning about 80°, so an even layer of light can be distributed over the entire landing area.

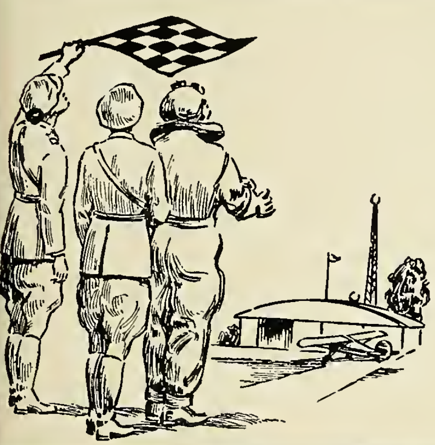
Twenty-three civil planes are registered in Denmark. Of these,

(*Continued on following page*)



Salmson six cylinder in-line engine developed in 1935





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STANAVO

AVIATION GASOLINE
AVIATION ENGINE OIL
ROCKER ARM GREASE

(*Continued from preceding page*)

5 are operated by the Danish Air Transportation Co., 10 are used in miscellaneous commercial flying, one owned by a business firm is used for advertising, and 7 are privately owned.

Edo float equipped Waco CPF for Brazilian river mail service

Great Britain

Sleeve valve engines more than confirmed early promise, as indicated by new data obtained in service in the Short *Syrinx* airliner. Two of the Bristol *Perseus* II.L engines, replacing two previous engines which had completed 300 hours of operation, also completed similar service.

Flying solo, in a standard Percival *Gull* with Gipsy-Six engine, H. F. Broadbent completed a flight between England and Australia in 6 days 21 hours 19 minutes compared with Kingsford-Smith's 7 days 4 hours 47 minutes, the old record. The only modification for the flight was the addition of an extra fuel tank in the cabin to increase maximum range to about 2,400 miles.

Preparations are being made at Air Service Training for instruction to Imperial Airways' pilots in handling of large marine aircraft. The ramp has been enlarged and moorings have already been constructed; equipment used for training will be Short *Calcutta* flying boats.

The Johnson Memorial Trophy, awarded for the best accomplishment in air navigation during twelve months, has been given by the Guild of Air Pilots and Air Navigators of the British Empire, to Capt. E. W. Percival for his one-day round-trip flight from England to Africa. In June he left Gravesend at 1:30 a.m. and arrived at Oran at 8:40. He was back at Croydon by 6:30 the same evening having flown 2,300 miles within 17 hours.

An air mail contract for service between Liverpool and Douglas, Isle of Man, has been awarded to British Airways, Ltd., the company recently formed by the association of leading operators in the British Isles. This is the third air mail contract held by the group.

Germany

Schkeuditz airport which serves Leipzig and Halle reported more traffic in the 1935 summer season than in the same season of 1934. Passenger traffic increased 54 percent, said to be greater than any similar increase in Germany. Outgoing mail from Leipzig increased 52 percent; incoming mail increased 250 percent. This is due to the movement of large quantities of raw furs delivered from Russia by air mail and after being dressed and dyed at Leipzig are again air mailed to their destination. Inks, medical instruments, spare machine parts, yeast and livestock are other items of importance carried. Air express traffic also increased. Sight-seeing passengers numbered 1,500 in 1934 and 4,500 in 1935; in addition, 12,200 children were taken on short flights at reduced rates.

As soon as the new Zeppelin LZ-129, now nearing completion at Friedrichshafen is ready, work will begin on a sister ship immediately. Pointing out that the LZ-129 is intended for North Atlantic trips to the United States, E. Giese, manager of the American Express Travel Service, reports that the itinerary will be from 2½ to 3 days, and that an extended regular Zeppelin service will be made to the Far East by way of the Indian Ocean.

Mexico

Mexican Aviation Co. (Pan American Airways) has established passenger, mail and express service, between Mexico City and Tuxpan, via Tampico. Service is one round-trip daily, except Sundays, with Lockheed *Electras*. Under experiment is an express service between Mexico City and Merida, Yucatan, with the same type of equipment.

After suspension for almost a month because of enforcement by the Ministry of Communications and Public Works of the law which demands that pilots and crews of transport planes must be born Mexicans, Aerovias Centrales, S.A. resumed service on its Mexico City-Los Angeles line, with its planes staffed exclusively by Mexicans. The Ministry states practically all of the 14 companies operating in Mexico have complied with the law and that those that have not will do so by January 28. It is expected that by next month there will be practically no foreign crews on passenger carrying planes.

Permanent certificates have been granted for aerial service between Mazatlan and Estacion Tavoltita and between Comitan and San Cristobal. Airways still being operated under experimental certificates total 3727.5 mi.

Adan Galvez Perez, of the Army Air Service, has been made chief of the civilian aviation section of the Ministry of Communications and Public Works.

Representatives of Junkers Aircraft Co. of Germany, conferred with Gerard Heimpel, mine operator of the Huizopa region, in Chihuahua state, with a view to establishing passenger, express and mail routes between the mines and Chihuahua City. Application for permission to operate the route already has been made.

A Pan American Airways' Lockheed *Electra,* carrying four officials of the company's Mexican division and two pilots, flew over Mount Orizaba, which has an altitude of 18,350 ft., and which is North America's second highest peak. This was the first time a plane ever flew over the mountain.

Preparations for the establishment of a civil aviation school in Mexico City to train Mexicans as transport pilots are being completed. Plans call for opening of the institution this year.

Spain

Details of the scheduled air traffic of L.A.P.E. in September, 1935, with August figures in parenthesis, are: Miles flown, 81,916 (88,670); passengers carried, 1,440 (1,281); mail carried (lbs.), 1,659 (1,614); baggage carried (lbs.), 25,053 (20,027); and express carried (lbs.), 15,591 (8,150). The length of the services was 6,202 miles during both months. Special and unscheduled flights over routes not regularly flown in September number 22; the mileage was 4,663 and the number of passengers was 78.

The daily except Sunday service between Madrid and Paris has been reduced to a weekly basis, and Lineas Aeroas Postales Espanolas and Air France, will continue the cooperative arrangement by which their planes alternate over the route. The change was made necessary by the lack of sufficient passenger traffic. The number of passengers carried from Madrid in recent months, with the traffic from Paris in brackets, was: June, 68 (80); July, 63 (76); August, 48 (86); September, 55 (100), and October 17 (37).

Services of L.A.P.E. will be extended from Stuttgart to Berlin and the Deutsche Luft Hansa service between Berlin and Barcelona will be extended to Madrid according to agreements between Spain and Germany. The Barcelona-Madrid service will be by alternate Spanish and German planes. The Spanish company has been authorized by its government to open two new services. The first is to be between Barcelona and Marseilles, 249 miles. The subsidy will amount to $1.21 per mile. Passenger fare is $17.06 and the express rate is 18 cents per pound. The second service is to be between Gando airport at Las Palmas in the Grand Canary Island to the Island of Tenerife, 75 miles. The subsidy rate is fixed at $1.10 per mile; the passenger fare and the express rate will be $9.56 and 4 cents per pound, respectively.

Russia

Soviet and Rumanian authorities have completed arrangements for a new daily service between Odessa and Bucharest. First flights will be made some time in May, according to A. K. Dawson, manager of the Russian Division of the American Express Company, and passengers and mail will be carried. Flying time will be six hours or less, as compared with the present 24-hour rail journey. Prominent in the new service will be the extension service through Bucharest to Prague. An air service organized jointly by the Czechs and the Soviets is now in operation, carrying mail between Prague and Moscow. This latter service stops at Kiev in the Ukraine and passes over Northern Rumania. While mail only is carried at present it is intended to add a passenger service this spring.

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(*Continued from page* 38)

LIGHT SEAPLANES—FOURTH CATEGORY

(one-place, empty weight less than 551.150 lbs.)

Altitude: Benjamin King (U. S. A.); Sept. 24, 1935; Anacostia, D. C.; Aeronca C-3 seaplane (36 h.p. Aeronca E II 3A) . . . . 15,082 ft.

Speed (100 Kilometers): Benjamin King (U. S. A.); Dec. 11, 1935; Miami, Fla.; Aeronca C-3 seaplane (36 h.p. Aeronca E II 3A) . . . 80.931 m.p.h.

Class C-3—Amphibions

Altitude: Harry Richman (U. S. A.); Jan. 29, 1935; Miami, Fla.; Sikorsky S-39 (300 h.p. Pratt & Whitney Wasp Junior) . . . . 18,641.682 ft.

Maximum Speed: Major Alexander P. deSeversky (U. S. A.); Sept. 15, 1934; Wayne County Airport, Mich.; Seversky amphibion (700 h.p. Wright Cyclone) . . . . . . 230.03 m.p.h.

Speed (100 Kilometers): Lieut. Richard L. Burke (U. S. A.); June 23, 1935; Cape May, N. J.; Coast Guard Grumman JF-2 amphibion (700 h.p. Wright Cyclone) . . . 173.945 m.p.h.

Speed (1000 Kilometers): Harry Richman and George Daufkirk (U. S. A.); Feb. 10, 1935; Sikorsky S-39 (300 h.p. Pratt & Whitney Wasp Junior) . . . . 99.945 m.p.h.

Altitude with 500-kilogram payload: Lieut. Richard L. Burke (U. S. A.); June 27, 1935; Cape May, N. J.; Coast Guard Grumman JF-2 amphibion (700 h.p. Wright Cyclone) . . . . 17,877.242 ft.

FEMININE RECORDS

Class C—Airplanes

Airline Distance: Amelia Earhart (U. S. A.); Aug. 24-25, 1932; Los Angeles to New York; Lockheed Vega (450 h.p. Pratt & Whitney Wasp) . . . . 2,447.728 mi.

Altitude: Marquise Carina Negrone (Italy); June 20, 1935; Montecelio, Rome; Caproni 113R (502 h.p. Pegasus S-2) . . . . 39,511.035 ft.

Maximum Speed: Helen Boucher (France); Aug. 11, 1934; Istres; Caudron 450 (315 h.p. Renault-Bengali) . . . . 276.527 m.p.h.

Speed (100 Kilometers): Helen Boucher (France); Aug. 8, 1934; Istres; Caudron 450 (300 h.p. Renault-Bengali) . . . . 256.235 m.p.h.

Speed (1000 Kilometers): Helen Boucher (France); Aug. 8, 1934; Istres; Caudron 450 (300 h.p. Renault-Bengali) . . . . 254.255 m.p.h.

LIGHT AIRPLANE—FIRST CATEGORY

Speed (100 Kilometers): Helen MacCloskey and (passenger) G. M. Savage (U. S. A.); Jan. 15, 1935; Miami, Fla.; Monocoupe (145 h.p. Warner Super-Scarab) . . . . 166.632 m.p.h.

Speed (1000 Kilometers): Helen Boucher (France); July 8, 1934; Istres; Caudron Rafale (145 h.p. Renault-Bengali) . . . . 155.396 m.p.h.

Altitude: Madeline Charnaux and Mlle. Clarck (France); Jan. 29, 1935; Orly; Farman 357 (120 h.p. Renault) . . . . 20,062.275 ft.

LIGHT AIRPLANES—SECOND CATEGORY

Airline Distance: Marsye Bastie (France); June 29, 1931; Le Bourget to Urino, Russia; Klemm (40 h.p. Salmson) . . . . 1,849.763 mi.

Altitude: Helen Boucher (France); Aug. 2, 1933; Orly; Mauboussin-Peyret (60 h.p. Salmson) . . . 19,356.897 ft.

Class C-2—Seaplanes

Altitude: Marquise Carina Negrone (Italy); May 5, 1934; Genes; Breda 15 (Isotta-Fraschini Asso) . 18,221.729 ft.

LIGHT SEAPLANES—SECOND CATEGORY

Altitude: Marquise Carina Negrone (Italy); May 5, 1934; Genes; Breda 15 (Isotta-Fraschini Asso) . 18,221.729 ft.

POINT-TO-POINT RECORDS

FIRST CATEGORY

Los Angeles to New York: Col. Roscoe Turner (U. S. A.); Sept. 1, 1934; Wedell-Williams (1000 h.p. Pratt & Whitney Hornet) . . Duration 10 hrs. 2 min. 51 sec.; speed 244.880 m.p.h.

SECOND CATEGORY

London to Melbourne: C. W. A. Scott and T. Campbell Black (Great Britain); Oct. 20-23, 1934; twin-engined de Havilland Comet (224 h.p. Gipsy Six) . . . . Duration 71 hrs. 18 sec.; speed 159.987 m.p.h.

Los Angeles to New York: D. W. Tomlinson, H. B. Snead, and F. R. Redpath (U. S. A.); April 30, 1935; twin-engined Douglas DC-1 (710 h.p. Wright Cyclones) . . . . Duration 11 hrs. 5 min. 45 sec.; speed 221.334 m.p.h.

FACTORY LAYOUT

(*Continued from page* 22)

time the assembly rack reaches the central aisle, the major parts are completely assembled. Minor parts are assembled after the rack crosses the aisle.

The pistons, heavily oiled, with the rings, are slipped on to the connecting rods. The cylinders, which have had valves, rockers, springs, etc., mounted and adjusted as part of the cylinder finishing operation, are next pushed over and bolted on. After placing Number 1 cylinder, which is the first to go on, the engine is timed. Then the push rods, their cover tubes, the intake pipes, oil pump, mixture heater and carburetor are installed. The engine is now assembled with the exception of checking the valve clearances and the snapping on of rocker box covers. After complete assembly the engine on the assembly rack is weighed and then rolled to the belting-in-machines, where the oil lines are connected and the engine run for a specified period.

The engine next passes to the test houses at the extreme east end of the plant, where it is put through a thorough manufacturer's test, at gradually increasing throttle, after which it is brought back to the Dis-assembly Dept. adjacent to the Assembly Dept. It is then dismantled for a thorough inspection of all parts, and any part showing imperfection is replaced. The engine is then re-assembled and is again passed to the test house for final test.

The engine is then taken to the spray booth where the outside is carefully cleaned. It then goes to the Packing and Shipping Dept., whence it is dispatched by rail which enters the building here.

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PERSONAIRLITIES

(*Continued from page* 85)

In 1918 he resigned from the Army and again entered commercial aviation. He made his first night flight in March, 1920. At that time very little night flying was done by commercial pilots.

Parla continued and still is active in commercial aviation in Cuba, being Inspector General of Airports. His stamina and determination enabled him to survive a week of entertainment and after-dinner speeches (few of which were entertaining) which he was to suffer from American aircraft salesmen and Bureau of Air Commerce officials while he was Cuban delegate during Air Navigation Week.

He recently was elected to membership in the Early Bird's, meeting, with plenty of room to spare, that organization's requirements. Now he can boast of comradeship with such illustrious company as his former associates in the flying game—including Beckie Havens, the youngest "old" seaplane pioneer of Hammondsport.

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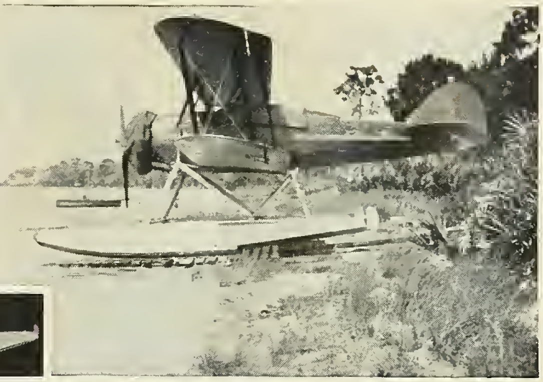

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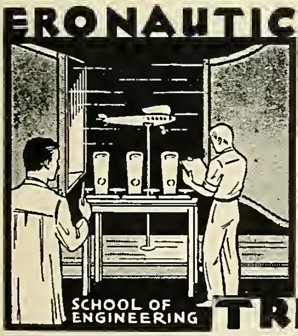

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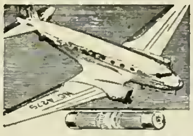

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FAIRCHILD KR-21: Excellent condition, above average. Kinner-powered. full airwheels. brakes, compass, airspeed; snappy color combination. $1,000 flyaway. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

IF YOU WANT A Monocoupe, here is your buy. 125 Kinner; just refinished. hand rubbed, buffed cowl; 280 hours total time. Built 1932. Guaranteed most beautiful in America and in perfect shape. Price. $1.795. Robert Kashower, Miramar Apartments, Washington, D. C.

WARNER PRIVATEER AMPHIBION: Perfect engine, No. 839: no time since major. Ship completely overhauled. refinished. No corrosion. Total time. 273 hours. Many extras. Sale, trade. AERO DIGEST, BOX 2215.

J-5 BUTLER HAWK: Completely equipped for blind flying instruction. Just relicensed. $1,100. Fred Kane, Fairfax Airport, Kansas City, Kansas.

AMERICAN EAGLE: 3POLB; front exhaust K-5, majored: licensed October. 1936; airwheels. adjustable steel prop. Reasonable: auto part payment. 206½ So. 27th St., Billings, Montana.

SWALLOW T.P.: OX-5. Licensed September, 1936. Scintilla magneto, Miller overhead. Always hangared. Fabric like new. Needs nothing. Price. $300. Laurie Yonge, Municipal Airport, Jacksonville, Florida.

FOR SALE: 2-place Curtiss-Wright Jr. Licensed. A-1 shape, new prop and windshield. Very little time since major overhaul and recovery. $375 cash, or will consider taking a ship that needs rebuilding as part payment. Charles Arneson, Box 33, Devils Lake, North Dakota.

AERONCA C-2: Single place. Licensed. Late type, tripod landing gear. Motor just majored. New covering, high finish, $425. Monty Barnes, Municipal Airport, Wichita, Kansas.

J6-9 MOTOR: $600. No time since major overhaul. modernized. Others asking around $900 to $1,200. Crated ready for shipment. Guaranteed as represented. Alton H. Walker, 600 Graphic Arts Bldg., Kansas City, Missouri.

TRAVEL AIR OX: Licensed. Good condition. Bargain, $475. Mulzer, Norton Field, Columbus, Ohio.

D H GIPSY MOTH: The biggest bargain in the north. 26 hours since major. Licensed until October 1936. Full air wheels. Extra equipment: skis. Licensed Russell parachute, one complete cylinder assembly. Gordon winter flying suit. The whole works for $795 cash. Harold Gessner, Escanaba, Michigan.

STINSONS: We have guaranteed used Stinsons of following models: SM8A, S, R and 1933 and '34 Reliants. These bargains have been taken in on new ships and put in first class shape both as to appearance and mechanical condition. Special equipment on most of these ships. Will trade or finance. Chicago Aviation Corporation, Glenview, Illinois.

185 H.P. CHALLENGER engine: Just majored; Scintilla mags, Stromberg carburetor. Inertia starter. Priced right. R. B. Gill, 1029 Placer Street, Butte, Montana.

LIGHT PLANES: All makes. Wonderful bargains in Taylor Cubs, Aeronca, Waco, Travel Air, Curtiss Jr. Terms arranged. Send stamps for list. Pioneer Aviation, Airport, Syracuse, N. Y.

AIRPLANES FOR SALE: 3 Fokker trimotors, equipped 3 Wasp 420 h.p. engines; ships fully equipped, each $2,100. Lockheed Orion, $9.500. Fairchild 42, $1,750. Northrop Gamma, Cyclone engine. Many other ships. Babb, 1100 Airway, Glendale, California.

REPOSSESSED PLANES: Brand new Taylor Cubs; Wallace Kinner 3-place cabin monoplane and Salmson Aeromarine Klemm, $300 down. Kinner B-5 Pitcairn Autogiro and J6-7 Travel Air biplane, $400 down and Szekely Buhl Pup, $200 down. Balance financed by easy monthly payments. Advise us monthly and down payment you can make. Aviation Finance Co., Hemlock, New York.

1935 AERONCA: Guaranteed like new, $1,350. Also '34 model. No time since factory major, $1,025. Also '33 model, no time since factory major, $925. Need cash; must sell. Cash or terms. Wire "Al" Leeward, New Kensington, Pennsylvania.

WACO CABIN: One year old. Hand rubbed finish, special streamlining. Less than 200 hours. 210 Continental, 1935 series. Total cost, $6,200; take $4,000 cash. OX Waco, good condition. engine perfect, new prop, $400. Used Continental Taylor Cub, 7 months old, new condition throughout, $950. Meinke-Eldred Flying Service, Willoughby, Ohio.

PORTERFIELD DEMONSTRATOR: 70 h.p. LeBlond. Speed ring. airwheels, airspeed, compass, etc. Total time, 60 hours. Ship and motor in excellent condition. $1,500 cash. M. J. Ernst, Sunset Airways, Chambersburg, Pennsylvania.

TANK WACO 90: Licensed; compass, airspeed; new 30 x 5 tires. Motor just overhauled. Will sell or trade for J-5 Waco or Travel Air. Pay cash difference. Will sell two OX-5's cheap. Harry Phillips, Phillips Airport, Mt. Pleasant, Michigan.

AERONCA C-3: Always hangared, recently majored and recovered. Like new. New prop. Navigation lights. $800 cash. A Padron, 76 N. E. First Street, Miami, Florida.

WACO F: 125 h.p. Kinner. Ship in good condition. Licensed until December 1936. Price $1,350. Taylor Aircraft Company, Bradford, Pennsylvania.

AIRPLANES, motors, crack-ups, parachutes, OX planes $75 up. Just out, Winter Directory containing owners' price, name and address, sent for 25c, postpaid. Aircraft Directory, Athens, Ohio.

HISSO E EAGLEROCK: 180 h.p. $1400 spent this ship last year; all modernizations, tulip valves, bronze rod bearings, cord rings, new prop, upholtery, covering, tires, fuel pump, instruments, windshields, etc. Practically new airplane. Sell $495 or trade 3POLB air-cooled, with cash difference. Eagle Hotel Corporation, Kingston, New York.

WACO GXE: Tank 115 h.p. New motor, new propeller; beautiful hand rubbed finish; chromium plated wires and struts; special cowling, speed windshields, shatterproof glass; compass, air speed, bank indicator; a wonderful performer. must be seen to be appreciated. A real buy at $925. W. E. Carpenter, 7128 Van Buren Ave., Hammond, Indiana.

DEADLINE FOR CLASSIFIED ADVERTISING, FEBRUARY ISSUE—JANUARY 17th

Copy arriving after that date will be held over for the March issue

CLASSIFIED ADVERTISEMENTS

10c. Per Word; $2.50 Minimum. Payable in Advance.

PLANES and ENGINES FOR SALE

WACO CUSTOM DeLuxe Demonstrator: Jacobs-powered. Less 100 hours. Less six months old. Like new; beautiful finish; many extras. Cost over $7,700; will sacrifice for quick sale. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

1935 STINSON RELIANT: Repossessed. Licensed to carry five. Never damaged and used only 54 hours. Special paint, lights and flares. Will sell with or without following equipment: RCA radio, Smith controllable prop, turn and bank, rate of climb, manifold pressure gauge and carburetor temperature gauge. This is a new airplane at a real bargain. Aircraft Finance Company, Curtiss Airport, Glenview, Illinois.

WACO, $325; Kinner Bird, $1,000; J-5 Travel Air, $795; American Eagle, $635; Velie 'Coupe, $385. Terms. Small down payment, balance easy. Write Pioneer Aviation, Airport, Syracuse, New York.

NEW AND RECONDITIONED used planes at reduced prices. Porterfield demonstrator, Taylor Cub 1935, Taylor Chummy (less engine), J-5 Travel Air. Kinner K-5 front exhaust engine and Cirrus parts. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

PITCAIRN PA-7M: Wright J6-7-D 250 h.p. engine. No time since major overhaul; ship just completely recovered. Has bank and turn, rate of climb direct electric starter, generator, retractible landing lights, Sperry horizon, indirectly lighted instruments. A real bargain at $1,275. Mulzer, Norton Field, Columbus, Ohio.

GYPSY MOTH: Just recovered, gold and blue; wing slots, Airwheels; unlicensed; $6[illegible]0. Detroit Aircat 60 h.p. motor, similar LeBlond, $100. Factory Church Midwing, uncovered, less motor, $75. Trades: Want NB-3, Arrow Sport, Robin, crackups. Kidd, Box 195, San Antonio, Texas.

$600 BUYS NB-8 (Trainer) ship in good condition. Genet motor 540 hours, 240 since major. Extra instruments. Always hangared. Trade late car. Challenger motor, 505 hours; 230 since new pistons and cam assembly. Needs first major. Price, $200. D. S. Beeman, Fort Stockton, Texas.

WACO 10: Licensed. Only OX Waco that can be flown inverted. Wonderful performer. Good condition. Best offer over $500. Stanley Keck, Box 204, Bethlehem, Pennsylvania.

FOR SALE: Two-place Security Airster, powered with K-5 100 h.p. Kinner, 165 h.p. heads. Fabric in excellent condition, motor fair. Folding wings. The Beech Aircraft Company, Wichita, Kansas.

WACO 10 GXE: Serial number 2079. Recovered, fuselage red, black stripe, wings silver. Complete overhaul. Just licensed. $550. C. B. Carroll, 55 Alice Apts., Latrobe, Pa.

FOR SALE: Fokker Super-Universal, Wasp B. Townend ring, 1120 lb. payload. Total plane and engine time, 700 hours. This plane is probably in better condition than any other of its type in the country. Has been flown by only one pilot and stored in a modern hangar. It has been used in testing aircraft radio equipment and never damaged, but the research possibilities have been exhausted on this type, necessitating its replacement with a more modern all-metal job. Best cash offer takes the plane. Aircraft Radio Corporation, Boonton, New Jersey.

FOR SALE, ENGINES: One Kinner K-5, late front exhaust engine. Complete rebuild and block test by large aircraft repair depot. New parts installed throughout, equal to new engine. Price, $485. One Wright J6-9-D, with all late conversions, including clutch. Complete rebuild and block test by approved repair station. Price, $975. Several nearly new Axelson B 150 h.p. engines (same bolt circle as Wright J-5), $100 each. One Wasp C, fair condition, best offer. For particulars, write Air-Parts, Inc., Glendale, California.

TAYLOR CUB with latest improved type Continental motor; new in September. Winter enclosure, navigation lights, compass and bank indicator. $1,100. Taylor Cub with Aeromarine motor, winter enclosure, compass and bank indicator, $875. Smith Flying Service, Wilkes-Barre Wyoming Valley Airport, Forty-Fort, Pennsylvania.

WACO GXE 10: Needs lower left wing, part of landing gear and prop to fly away. $175. P. O. Box No. 32, McAlevy's Fort, Pa. Phone: 60-R-3.

SALMSON AEROMARINE KLEMM: 10 hours since top overhaul. Fabric controls recovered, plywood very good condition. Dual controls. Licensed October 1936. $450 cash. Mermell, 216 Troutman St., Brooklyn, New York.

CHALLENGER ROBIN: Hamilton propeller, turn and bank, tail wheel, starter. 120 hours since major, new pistons, etc. If you are looking for a good Robin, make us an offer. Airport, Lock Haven, Pennsylvania.

ALL MAKES cabin and open planes, air-cooled motor powered; many like new. Prices are cheap. Small down payment. Send stamps for list. Pioneer Aviation, Airport, Syracuse, New York.

AERONCA C-3: Two-place. In good condition. A bargain at $600 for quick sale. AERO DIGEST, Box 2220.

AIRPLANE BARGAINS: Fast Warner Monocoupe in excellent condition; Lambert Monocoupe with factory reconditioned motor; J6-7 Waco, wonderful performance; Hess-Warrior Argo: OX-5 Command-Aire with Scintilla magneto; Salmson powered American Eaglet, just rebuilt; Taylor Cub demonstrator with very little time. Write for further particulars. Airport, Natick, Massachusetts.

KINNER BIRD: $1,100. Original owner. Never cracked. Goodyear Airwheels, Pioneer instruments. Motor and ship completely rebuilt September 1935. Licensed August 1936. Will trade on Stinson S. Irvin seat pack, modernized, drop tested, $75. Robert Whipp, Logan Field, Baltimore, Maryland.

TRAVEL AIR 4000-K: Kinner, full airwheels, brakes, steel propeller; $975. Trades considered. Dick Schall (College Park Airport) Berwyn, Maryland.

KINNER BIRD: $975. Licensed to November. Plane just refinished. Airwheels. K-5 motor. 140 hours since major. A real bargain. Donald Hood, Belmont Ave., Northampton, Mass.

STINSON S: Completely reconditioned and Lycoming engine major overhauled with new heavy-duty crankshaft installed. Ship completely refinished and in A-1 shape. Stinson SM7B: Wasp Jr. recently majored and prop etched and tracked; radio, flares, landing lights, ring, pants, bank and turn, rate of climb, ice warning, starter, generator, etc. Entire ship in excellent shape. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pa.

FOR SALE: J-5 4-place Stinson, licensed to October 1936. $900. Hangar 33, Roosevelt Field. Hal Provo, 141-11 249th Street, Rosedale, L. I., N. Y. Phone: Laurelton 8-3977.

FOR SALE: Model A-2 Eaglerock, licensed to October 1936. Many extras. Sacrifice. Blue and cream. Adolf W. Reimer, 69-37 78th Street, Middle Village, Queens, New York.

AERONCA C-2: Fairchild cabin J-5: J-5 Travel Air: Challenger Command-Aire. All ships licensed, in first class condition and reasonably priced. Air Activities Airport, West Chicago, Illinois.

J-5 STEARMAN C3B: 30 hours since overhaul. Excellent condition, $1,000. Cirrus Avian real buy, $450. Will trade one or both. Gus Michelson, Hangar 33, Mineola, New York.

WACO F-3: Exceptionally fine condition; never used commercially but beautifully maintained by private owner on own field; only 140 hours total time: never damaged: Jacobs engine just had the new type knuckle pins installed and top overhaul: extras; $3,500 cash. Travel Air biplane: Wright 165 h.p.: 18 hours since engine major overhaul; licensed to May 1936. $1,200 cash. Havens & Depew, Hangar C, Roosevelt Field, Mineola, New York.

AMERICAN EAGLE: Kinner K-5; licensed, good condition, new tires and propeller. Sell as is or less engine. Accept light ship on trade. Bob Curry, Seymour, Indiana.

PRICED TO SELL OR EXCHANGE: 17 certified airplanes: J-5 Straightwing Waco; J-6 B-5 6-place Ryan cabin ship, airwheels; J6-9 330 h.p. Travel Air cabin ship, full airwheels; J6-7 250 h.p. Waco; Cirrus 95 h.p. 2-place Driggs training ship; 3 Type 2000 OX-5 Travel Airs; OX-5 Curtiss Robin; Continental A-40 powered Heath; 3 J-5 or J6-7 Pitcairns, with or without motors, many extras; 2 OX-5 Waco 90's; J-5 Ryan B-1 five-place cabin ship; Velie Monocoupe. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Michigan.

J-5 TRAVEL AIR: Model B-4000. Just major overhauled, new fabric, beautiful finish, new 1937 license. $1,350 flyaway. See this airplane. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

SPECIAL STINSON MODEL R: Airplane built specially for executive use, with down cushions, high-back reclining rear seats, whipcord upholstery. Total time 362 hours, 92 hours since engine major overhauled by Lycoming service station. Rate of climb, turn and bank, retractable landing lights, bonding, shielding and Lear radio, 75 gallon gas tanks, beautiful rubbed finish of red with gray contrast. Priced right. G. D. Owsley, Glenview, Illinois.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $750. Wasp S1D1, $2,500; Wasp C, $1,100; Wasp B, $800. J6-9-D, $1,250; J6-7-E, $1,250; J-5, $450. Lycoming 215 h.p., $595. Challenger 185 h.p., $400. Kinner K-5, $300. Babb, 1100 Airway, Glendale, California.

BIRD, KINNER K-5: A-1 condition, licensed. Semi-Airwheels. Quick sale, $975. Mulzer, Norton Field, Columbus, Ohio.

AERONCA C-3: Recently majored E-113-A motor. Wings recovered and ship refinished in November. Enclosure, air wheels; to be sold with or without floats. AERO DIGEST, Box 2210.

LAMBERT MONOCOUPE: 355 hours; ship throughout in excellent condition; eight-day clock; steel propeller; motor factory rebuilt. Never damaged; always privately owned. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

WACO F: Warner engine; 75 hours since major. Steel prop. In excellent condition throughout. $1,250. Louisville Flying Service, Inc., Bowman Field, Louisville, Kentucky.

CHALLENGER ROBIN: Licensed. Beautiful ship. Motor just majored. Covering excellent. Special upholstering. Starter, extras. $985. Monty Barnes, Municipal Airport, Wichita, Kansas.

TAYLOR CUB: New October 7, 1935. 60 hours total. Perfect condition and never damaged. Red and silver paint job. J. Willard Miller, Lock Haven, Pennsylvania.

BEST BUYS ON PAGE, less motors: B-5 6-place Ryan cabin ship, full airwheels, less motor; B-1 5-place Ryan cabin ship, full airwheels, with or without J-5 motor; J6-9 Travel Air 6-place cabin ship, airwheels, excellent condition; J6-7 250 h.p. Pitcairn, airwheels, loaded with instruments. These ships all NC licensed and priced to sell. Michigan Aero Motors, Jackson, Michigan.

GUARANTEED USED AIRPLANES: Our certified used airplanes, licensed and ready to fly away, include the following makes: Bubl Pup, Gipsy Moth, J6-5 Command-Aire (just recovered), Continental Waco cabin and Stinsons from 1930 models up to and including new Stinsons which have had only a few demonstration flights. Will take in trades or finance any of the above. Stinson trade-ins preferred. Chicago Aviation Corporation, Glenview, Illinois.

J-5 STINSON: Motor just overhauled. Plane recently recovered, newly licensed. A steal at $1,095. Terms arranged. Write or wire Pioneer Aviation, Airport, Syracuse, New York.

CLASSIFIED ADVERTISEMENTS

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PLANES and ENGINES FOR SALE

/ARNER CESSNA, WARNER STINSON: Both iips perfect condition; either one for sale or trade pen job. Also for sale, Lamhert engine, just re-uilt. Miki, 272 West Flagler Street, Miami, Florida.

AIRCHILD KR-21: Ship and engine in excellent ondition; semi-airwheels and brakes; just refinish-d. Exceptional buy at $1,050. Ray P. Hylan, ochester Airport, Rochester, New York.

ELLANCA SKYROCKET: Wasp C; 220 hours, ecovered 1934; new tires, radio. Wiley flares, speed ng, all blind flying instruments. Ship always wned by private family, has had beautiful care. ,500. Just relicensed. Travel Air 6000-B J6-9-D; odernized 330 h.p. Recovered 1933; has 85 hours nce major by Pacific Airmotive, late impeller as-embly, forged pistons; radio, flares, jumbo tires, l blind isstruments. $2,550. Just relicensed. Mou-n & Six, San Francisco Airport, San Bruno, Calif.

/RIGHT J-5 ENGINE; Total since major over-aul, 176 hours; good condition, complete, $215. ulzer, Norton Field, Columhus, Ohio.

AMBERT MONOCOUPE: Semi-air wheels and rakes, steel propeller, racing type landing gear; mpletely recovered last spring; licensed to June 36. $1,000. Bahe Alsworth, Sherhurn, Minnesota.

OR SALE: Two Aeroncas, purchased in May d June 1935; $1,350 and $1,450. Time payments. inson Reliant, special paint, flaps, all necessary struments; no engine time since factory major, ,000. Challenger Robin, just relicensed; engine me 75 hours total; $1,000. J-5 Stearman C2B, time since major on ship and engine; $1,300. andard Aviation, Inc., Teterboro Airport, Has-ouck Heights, New Jersey.

RIMOTOR STINSON "U": Latest model; J6-7-E otors, just majored. Little total time. Drect from astern Air Lines. Perfect condition throughout. ,750, less motors. Western Airplane Distributors, 0 Graphic Arts Bldg., Kansas City, Missouri.

YCOMING STINSON: Late SM8A model with rwheels, motor ring. Flare, landing lights, radio, ajored, new cylinders. $1,450. Terms arranged. ioneer Aviation, Airport, Syracuse, New York.

OR SALE: F-5 Waco; Jacobs Cabin Waco; Stin-n Reliants; Great Lakes; Bellanca Skyrocket and acemaker; Kinner Fleet; Warner Fairchild 24; 'arner Fairchild 22; Lamhert Monocoupe; Warner onocoupe; Stinson S. Aircraft Sales Co., Hangar , Roosevelt Field, Mineola, New York.

PLACE J6-7 NEW STANDARD: Believe no andard left its equal. Fabric, finish and struc-re perfect. 25 hours snce motor top overhauled. 50 x 12 wheels and tires. Cash, $1,650. AERO IGEST, Box 2225.

OR SALE: Arrow Sport; two LeBlond power-ants, now rebuilding. Complete, $550; or will sell e powerplant less crankshaft. Lou Jacohson, 154 ast 87th Street, New York, N. Y.

AYLOR CUB: Continental A-40-3; enclosure. anufactured August 1935. Make offer. Take car ship on trade. Howard Schmidt, 2016 Whitestone ve., Whitestone, L. I., N. Y.

RAVEL AIR: J-6 330; fuselage recovered, wings finished in September; speed ring, new tires, heels, bank and turn, compass radio shielded, ght flying equipment; relicensed to October 1936. onarch Air Service, Mimicipal Airport, Chicago, linois.

HALLENGER CURTISS ROBIN: Licensed ugust; brakes, 750 x 16 tires, Hamilton steel pro-eller, tail wheel; or trade for J-5 Travel Air open similar ship. Earl Sark, Mosheim, Tennessee.

CUSTOM-BUILT 5-place Standard: Built by Metropolitan Aircraft Corporation. Total time 110 hours; special cowling, speed ring, semi-airwheels, brakes, complete upholstery, piano finish. Cruises 105, tops 120. Perfect condition. Sell or trade for Stinson R or '33 Waco Cabin. B. Huppert, 133 Union Place, North Bergen, New Jersey.

WACO J-5 STRAIGHTWING: Heywood starter, semi-airwheels; engine just majored; $1,200. Stinson SM8A: Night flying equipment, just relicensed; $1.700. Steep Air Service, Detroit City Airport, Detroit, Michigan.

FOR SALE at Closing Out Bargain Prices: J6-5 175 h.p. Wright motor, $225. J-4 220 h.p. motor, $195. J6-7 250 h.p. Wright motor, $575. Nearly new J6-9 330 h.p. Wright motor, $850. J6-9-E Wright motor, no time since overhaul, priced on request. J6-7-E 250 h.p. Wright motor, priced on request. Steel propellers for above motors priced on request. All Warner and Wright motor parts, 60% to 80% off. B-1 5-place Ryan cabin ship, less J-5 motor, $675. We are closing out. Write or wire your needs. Michigan Aero Motors, Jackson, Michigan.

WACO "A": Late '33 Jacobs; no time since major; radio, bank and turn. Heywood starter, wheel pants. speed ring; yellow fuselage, green wings; excellent condition. Price $2 650. Great Lakes 2T1, licensed September 1936; Airwheels, wings and tail surfaces just recovered; excellent condition, $950. Straightwing Waco, 175 h.p. Wright J-6, 15 hours since majored and modernized; electric starter; tail wheel. fuselage recovered high lustre finish; real buy, $1.250. John T. Corrodi, Inc., Box 185, Bexley Station, Columhus, Ohio.

PITCAIRN: J-5 motor just majored; landing lights, flares, starter. Ship in dandy condition. Best offer takes ship. Take trade. Phil Miraglia, 208 Irvington Drive, Tonawanda, New York.

CHALLENGER 185: Invincible 4-place cabin; 300 hours, identified, $585. Navigation lights. inertia starter, Hamilton steel prop, brakes. tail wheel, dual wheel control. Roy Hume, Arkansas City, Kansas.

AERONCA: Late 1934. Type 113-C motor. Less than 80 hours on ship and motor. Brakes, enclosure, heater. Ship and motor in absolutely new condition. A bargain for cash. C. H. Moment, Municipal Airport, Hastings, Nehraska.

WANTED TO BUY OR TRADE

WANTED: Inverted American Cirrus engine in any condition, or parts for same. Must be priced right for cash. AERO DIGEST, Box 2208.

WANTED: Will pay cash for used Fairchild, either 51, FC-2W-2, or 71. Send description and price to Southwestern Aerial Surveys, Inc., Austin, Texas.

SPOT CASH PAID for your airplane, motors or parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WANTED: Complete motor cowling for 2T1A Great Lakes, using American Cirrus Mark III motor. Wesley Lewis, Pampa, Texas.

WANTED: Warner Fleet, Warner Monocoupe and Fairchild 22. Must be in good shape. Anthony Nunes, 39 Ringold Street, Marlhoro, Massachusetts.

TRADE FOR SHIP: All or part 160 acres land, southern Mississippi. Good farm or investment. Good prospects for gas and oil. What have you? AERO DIGEST, BOX 2213.

WANTED: Warner 90 or 125, thirty series or later. Give serial number, complete history, hours flown. Cash. John J. Atkinson, Box 311, Luhbock, Texas.

CASH: For your airplane or airplane parts in any condition. Want J-5, J-6 motors, parts and propellers, air wheels and instruments. Write details in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

TRAVEL AIR C-4000: Fuselage, rudder, fin; covered or uncovered, all struts. Must be in good condition. Also Kinner B-5 and Lamhert 90 engines, any condition. Serv-Air, Inc., Raleigh, North Carolina.

WANTED: Four-place cabin monoplane; three-place aircooled biplane. Must be cheap and licensed. Send complete description and photo first letter. Box 334, Sheldon, Iowa.

CASH FOR new upright or inverted American Cirrus; also two new or used Scintilla magnetos for Curtiss OXX-6. Madson Flying Service, National City, California.

STINSON CABIN SM8A: To exchange for light air-cooled job and difference. J. E. Blythe, 1108 East Admiral, Tulsa, Oklahoma.

CRACKED CHALLENGER FLEDGLING: In good shape; also Mercedes sport touring. Will trade for light plane similar Moth or Aeronca. Fritz Y. Mercer, Georgetown, South Carolina.

WANTED AT ONCE: 10 airplanes for cash, regardless of condition. Give full information in first letter. Glenn Fellows, Box 66, Jackson, Michigan.

WANTED: Wright J6-9 engines, any condition. Bahb, 1100 Airway, Glendale, California.

ANY LICENSED AIRPLANE: Trade 1934 1½ ton Ford truck, heavy duty frame, large van body. new heavy-duty tires. Perfect condition, ready to earn on long hauls. Pay cash difference where value indicated. Aviation Finance Co., Hemlock, New York.

CASH PAID: For your airplane or parts in any condition. Want engines, parts, airwheels. State full particulars in first letter. Floyd Becker, Aberdeen Road, Grand Rapids, Michigan.

WANTED: OX Robin, covered or uncovered, with or without engine; or wings, empennage. windshield, oleo landing gear and fittings. AERO DIGEST, Box 2221.

WANTED: J6-5 Whirlwind and Challenger Robins. Give complete history and lowest cash price in first letter. Also direct electric starter for J6-5 Whirlwind. Art Walters, Baker, Oregon.

WANTED: Travel Air, Command-Aire, Waco, Savoia-Marchetti or similar class, 100-220 horsepower. Condition immaterial. Give full details. Cash. Jack Frenzl, Appleton, Wisconsin.

WANTED: New Altimeters—Zenith, Tycos or any AN specification in lots of 50 to 5,000. Give type and best cash price. Woodham, 11405 Inglewood Avenue, Inglewood, California.

I WILL PAY CASH for J-5 Ford trimotor. State lowest price, details, motor and ship condition in first letter. If it isn't a J-5 Ford, don't reply. AERO DIGEST, Box 2222.

WANTED: Scintilla magneto PN4-D, L.H. rotation preferred. Advise best cash price and condition. Also one Velie or LeBlond propeller with hub. M. A. Beckmann, 3458 Vine St., Cincinnati, Ohio.

WANTED: Stinson S, preferably one in need of overhaul or repairs. Have 165 Continental, 125 hours, bargain. Portland Flying Service, Inc., Portland, Maine.

WANTED: 3 LAMBERT MONOCOUPES: Any condition. Cash for used airplanes and crack-ups. Give general condition and price. Have slip-on covers at attractive prices. Consolidated Aircraft Repair, Inc., Municipal Airport, Fort Wayne, Indiana.

DEADLINE FOR CLASSIFIED ADVERTISING, FEBRUARY ISSUE—JANUARY 17th

Copy arriving after that date will be held over for the March issue

CLASSIFIED ADVERTISEMENTS

10c. Per Word; $2.50 Minimum. Payable in Advance.

WANTED TO BUY OR TRADE

WANT TO BUY: Two- or three-place air-cooled ship; must be exceptional bargain, around $500 cash or terms on small balance. Give details, snapshot. H. Cullen, 5736 No. Colgate St., Philadelphia, Pennsylvania.

WANTED: Travel Air 2000 or Speedwing, with center section tank, detachable motor mount, less motor and covering. Late type undercarriage. Two Scintilla magnetos for Hisso E. Carson Alexander, P. O. Box 1451, Roanoke, Virginia.

WILL TRADE: New Ford, Chevrolet or Plymouth, any body type, for good used plane. Two- or three-place air-cooled. Licensed. Would pay cash for bargain. Bird, Arrow Sport or similar ship. B. Ferguson, Clinton, South Carolina.

WANTED: Waco F or Bird airplane, with or without engine. Will pay cash for complete airplane or crack-up, or will trade my Warner Fleet. A. G. Anderson, 5300 W. 63rd St., Chicago, Illinois.

WILL TRADE 22-foot motor boat for good two- or three-place plane. Steel hull, convertible cabin; marined Cadillac engine, clutch, reverse, starter, generator, everything in perfect condition. Only 35 hours since complete machine shop overhaul, new propeller and shaft; will do 20 miles per hour; strong, fast, leakproof. Trade for good newly licensed ship, no junk, or sell boat for $800. R. S. Dunn, 720 N. Broadway, Greenville, Miss.

WANTED: Semi-air wheels to fit tire 22.650 x 10, axle 1⅛ inch. C. E. Bruce, Hartsville, S. C.

WANT TO BUY: Pioneer 385-B turn and bank in good condition. Also Kollsman sensitive altimeter. Quote best cash price. C. H. Moment, Municipal Airport, Hastings, Nebraska.

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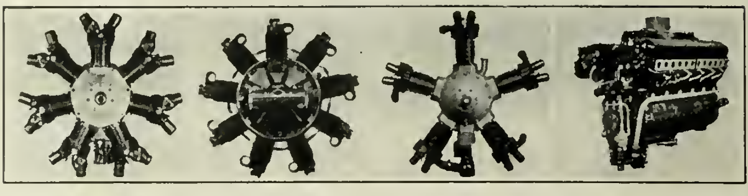

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Volume 28 *Number 2*

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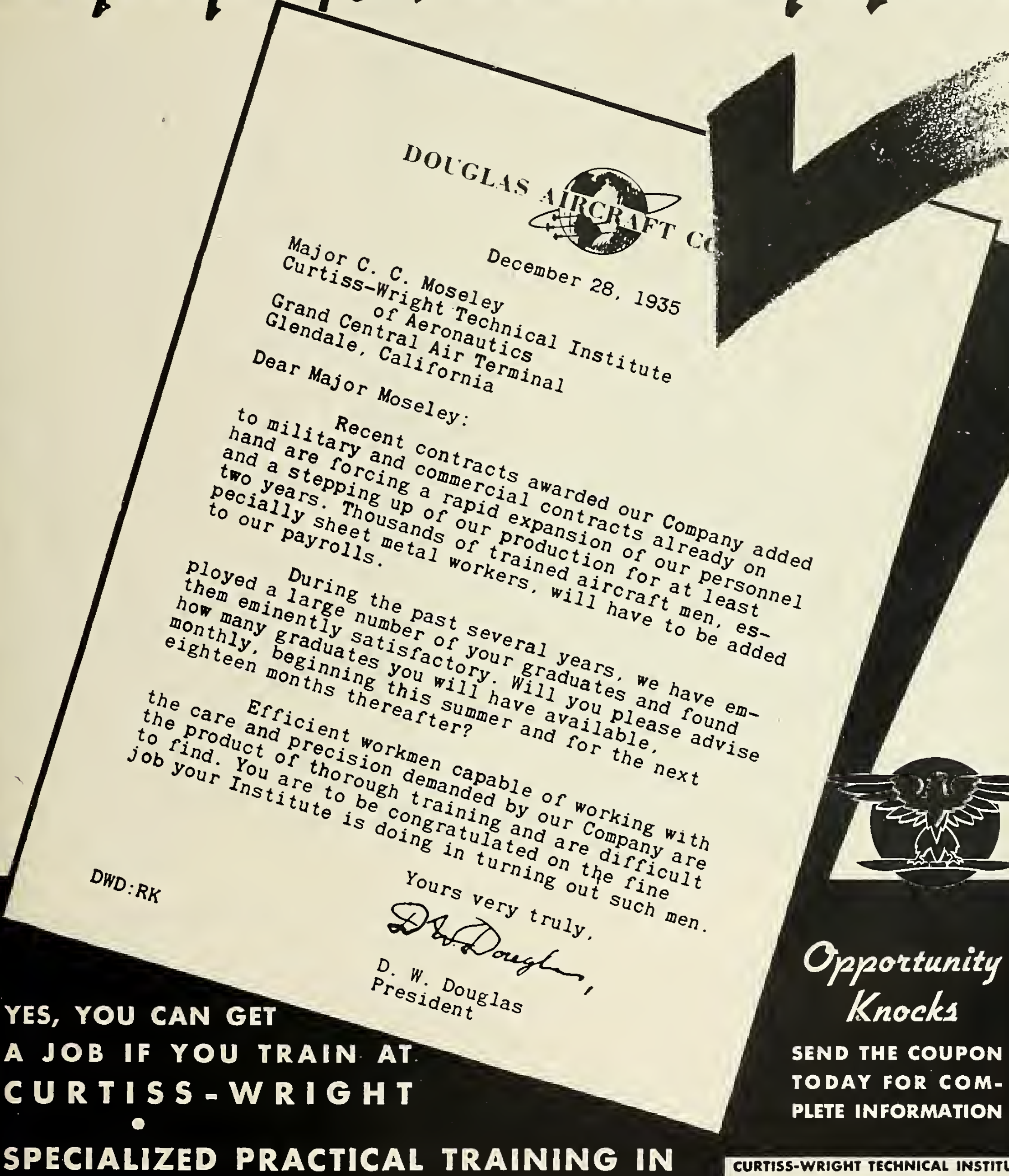

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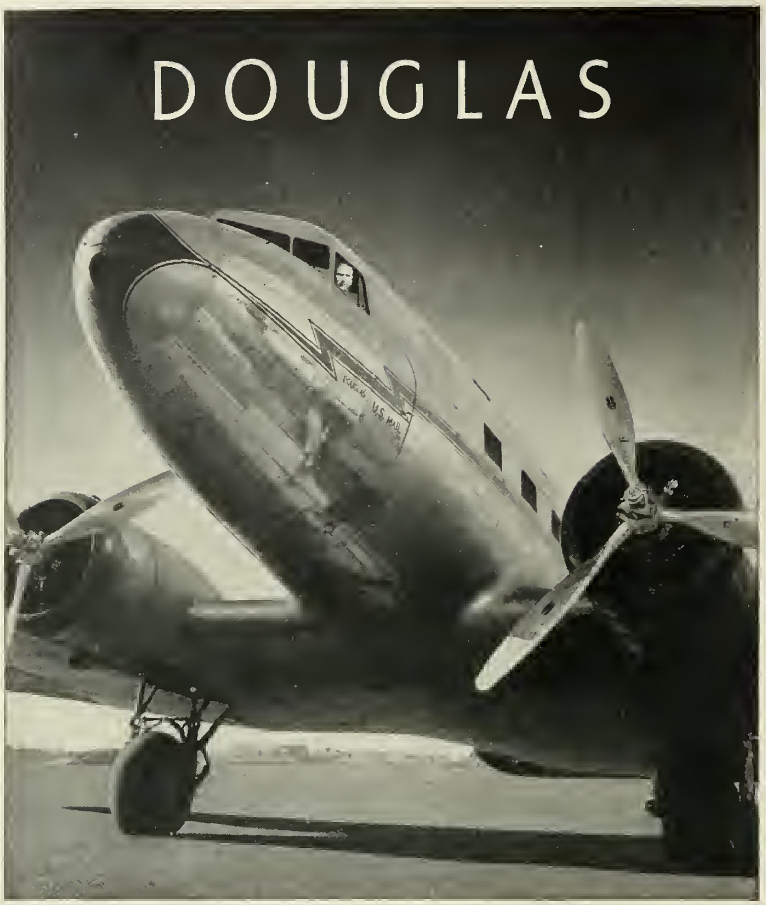


You Designed this Transport

Development of the new Douglas Sleeper Transport represents one of the most conscientious efforts ever undertaken to satisfy public demand for basically new improvements in air transportation.

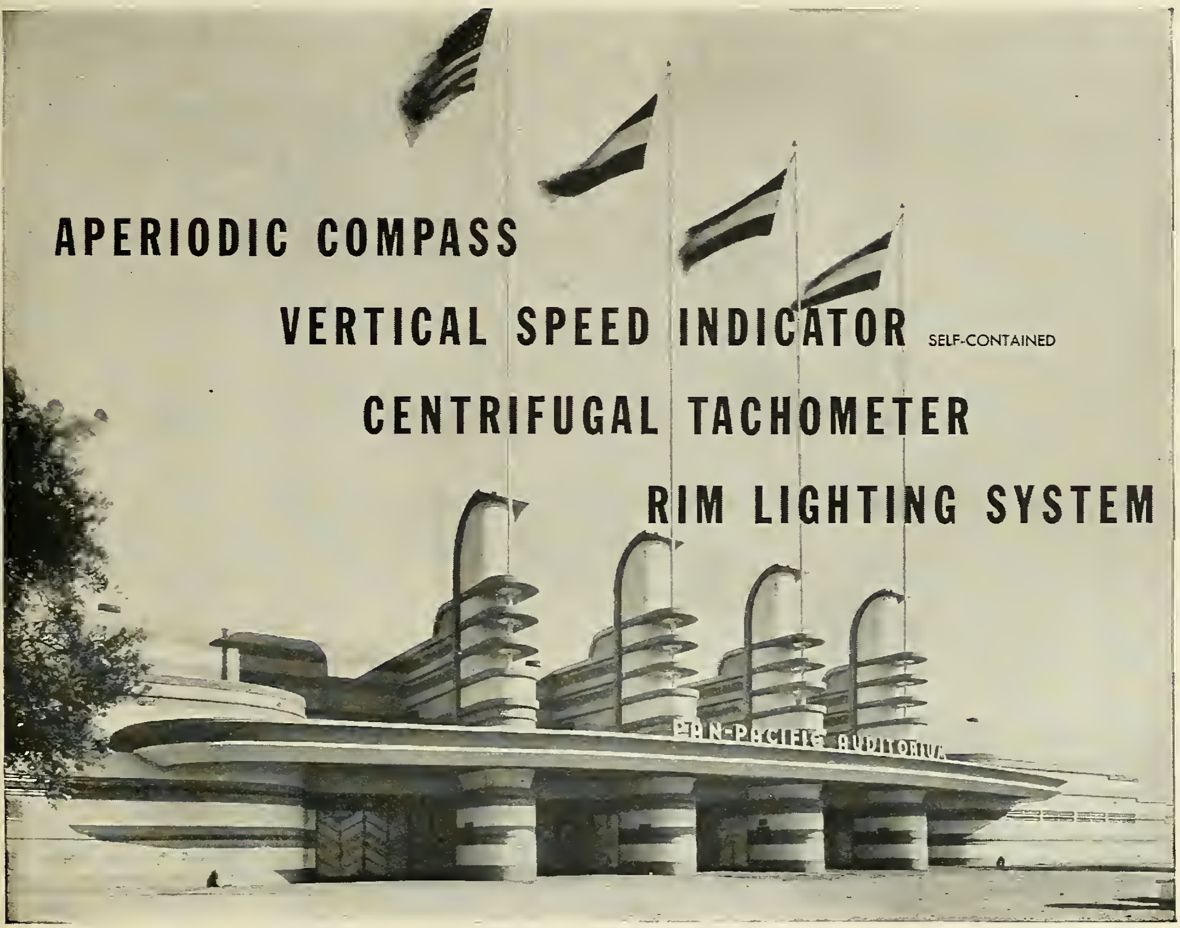
Based on the opinion of literally thousands of air travelers, Douglas produced this airplane — the first transport designed exclusively for night flying which in one bold stroke has combined spacious comfort with tremendous speed and entirely new features of security. The soundproofed cabin provides privacy for sixteen passengers, and there are separate dressing rooms and lavatory facilities, and a fully equipped galley. The impetus which the new Douglas Sleeper Transport is destined to give to air travel can be compared only to the stride made by railroads with the introduction of the Pullman car. Douglas Aircraft Company, Inc., Santa Monica, California.

Douglas . . First Around the World

WHEREVER YOU GO, TRAVEL VIA LUXURIOUS DOUGLAS EQUIPMENT
IN AMERICA on American Airlines, Eastern Air Lines, Pan American Airways, and T. W. A., Inc.
IN SOUTH AMERICA on Pan American Grace Airways
IN EUROPE—OELAG in Austria; Deutsche Lufthansa in Germany; K. L. M. in the Netherlands;
L. A. P. E. in Spain; LOT in Poland; Avio Linee Italiane in Italy; and Swissair in Switzerland.
IN THE ORIENT on Japan Air Transport, China National Aviation Corporation, and K. N. I. L. M. in the Netherlands Indies.

THIS is the *secon*
of a series of advertisements appear
ing in TIME Magazine.

ON VIEW • 4 NEW KOLLSMAN DEVELOPMENTS



APERIODIC COMPASS

VERTICAL SPEED INDICATOR SELF-CONTAINED

CENTRIFUGAL TACHOMETER

RIM LIGHTING SYSTEM

LEADERSHIP ON DISPLAY

Kollsman leadership in the development and manufacture of Precision Aircraft Instruments is again exemplified by new and important aids to instrument-directed flight . . . displayed for the first time at the Kollsman Exhibit in the Los Angeles Aircraft Show.

KOLLSMAN

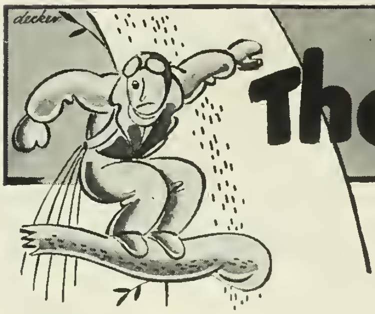
KOLLSMAN FOR PRECISION

ACCELEROMETERS • AIR SPEED INDICATORS • ALTIMETERS • SENSITIVE ALTIMETERS • CLOCKS • COMPASSES • ARMY AND NAVY STANDARD COMPASSES • APERIODIC COMPASSES • ENGINE GAGE UNITS • FUEL QUANTITY GAGES • OIL AND FUEL PRESSURE GAGES • ICE WARNING INDICATORS LEVEL FLIGHT INDICATORS • MANIFOLD PRESSURE GAGES • PITOT STATIC TUBES, FOR MONOPLANES AND BIPLANES, WITH OR WITHOUT ELECTRIC HEATER • SUCTION GAGES • TACHOMETERS, CENTRIFUGAL AND ELECTRIC • THERMOMETERS, OIL, WATER, MANIFOLD AND CARBURETOR • VERTICAL SPEED INDICATORS • SPEED AND DRIFT INDICATORS

PRECISION AIRCRAFT INSTRUMENTS

KOLLSMAN INSTRUMENT COMPANY, 5 JUNIUS STREET, BROOKLYN, NEW YORK

WESTERN BRANCH, 1224 Airway, Glendale, California EUROPEAN DIRECTOR: Com. M. Calderara, 47, Av. de Brimont, Chatou (S. & O.) France



The Birdmen's Perch

Thanks, fellows. In response to last month's requests for gossip, criticism and suggestions for this page, we got enough letters to fill a small blimp. Keep up the good work, please. We'll take care of requests in order of their arrival. Address your correspondence to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Refining Company, Pittsburgh, Pa.

NOW YOU TELL ONE!

"A FRIEND tells me that in the days when ships were young and pilots were Frank Merriwells, the following incident actually happened.

"A barnstormer, after a take-off, found that he'd damaged his landing gear. Mildly disturbed, he kicked a hole through the fuselage, hung by his knees and fixed the gear with a piece of wire.

"If this is true, can any old-timer give me the man's name?" —P. R. S.

DID YOU KNOW?

That there actually was a Darius Green. Albert Damien, Scotch but not canny, made wings with a feather covering and jumped off a barn. He didna jump again.

That when Pilate de Rogier and Marquis d'Arlandes were about to make the first ascension in a free balloon, there were suggestions that condemned criminals go up instead and be pardoned if they survived.

That at the All-American Air Races held in Miami, December 12 to 14, Gulf products won 8 out of 9 race events, established two world's records and one national record.

BIG MOMENTS IN AVIATION

5 Years Ago:—Feb. 4, 1931—U.S. Navy dirigible Los Angeles leaves Lakehurst, N. J., at sundown. Arrives at Guantanamo, sundown Feb. 5.

7 Years Ago:—Born at Gulf's Port Arthur Refinery, a new refining process, the Alchlor process, that made possible the world's greatest motor oil, *Gulfpride.*

In 1935, at National Air Races, Harold Neuman, Thompson Trophy winner, and Benny Howard, first in Bendix race, fly ships lubed by Gulfpride.

10 Years Ago:—Feb. 10, 1926—Commander Franco concludes his flight from Spain to Buenos Aires, via Canary and Cape Verde Islands.

SQUAWK!

"I think this 'temporary' restriction of regular airways in overcast weather to transport pilots and airmen with proper radio equipment is an outrage. I can keep out of the way of transport pilots in fair weather or foul." —B. D. F.

REBUTTAL!

"B. D. F. just showed me his letter and I claim he should be taken out and paddled. This 'temporary' restriction should be made a PERMANENT measure. This rule will save plenty of skins, maybe even B. D. F.'s own hide." —R. T. M.

THIS MONTH'S WHOPPER

"I shall never use your Gulf Aviation Gas again.

"Last week I tried it in my plane and it gave the ship so much zip that I decided to use it in my car. So I filled the tank and started to drive to town from the Floyd Bennett Airport.

"The fool car started soaring into the air. I took my foot off the accelerator, but the darn bus still kept on climbing.

"Imagine my embarrassment! I was pointed towards Chicago, and nobody to save me when the gas ran out! I did some tall thinking and decided to rig up a parachute. I took off my shirt, pants and underwear. I tied them together and pasted the seams with tire tape.

"About Youngstown I bailed out. The parachute worked. But it was sure one cold trip down!

"I landed in Warren, Ohio, and they took me to an asylum. Two days later they let me out.

"The last I heard of my car it was reported to be sailing over the Fiji Islands, and still going strong.

"I guess a little Gulf Aviation Gas will take you a long way. *You*, not *me*, I mean." —F. H. J.

GULF AVIATION PRODUCTS

GULF

Write to the Gulf Refining Company, Pittsburgh, Pa., for your free copy of the Gulf Aviation Atlas.

YOUR FUTURE . . . and COMMERCIAL AVIATION

What of your future? You may have already decided . . .

Perhaps you are one of the many thousands of men whose imaginations have been captured by the spectacular achievements of commercial aviation . . . by the performances of huge transport planes which daily wing their way back and forth across these United States with safety, comfort and speed that even three short years ago would have seemed miraculous. Maybe you have the vision to see that the crossing of the Continent by giant airliners with luxurious ease in sixteen hours, or less, many times daily . . .

The carrying of a million air passengers in forty-two million miles of flying in this country alone in 1935 . . .

The spanning of the mighty Pacific in sixty hours by the epoch making Clipper ships . . .

The daily scheduled crossing of the North Atlantic, which, Igor I. Sikorsky says, is now at hand . . .

And the circling of the entire globe by commercial planes in scheduled service . . .

Perhaps you look on all these things, not as the ultimate of achievement in aviation but only as a beginning, as an idex to the tremendous expansion which, competent authorities agree, the years just ahead will witness.

You may have already decided that you want *your future* to be identified with that of aviation . . .

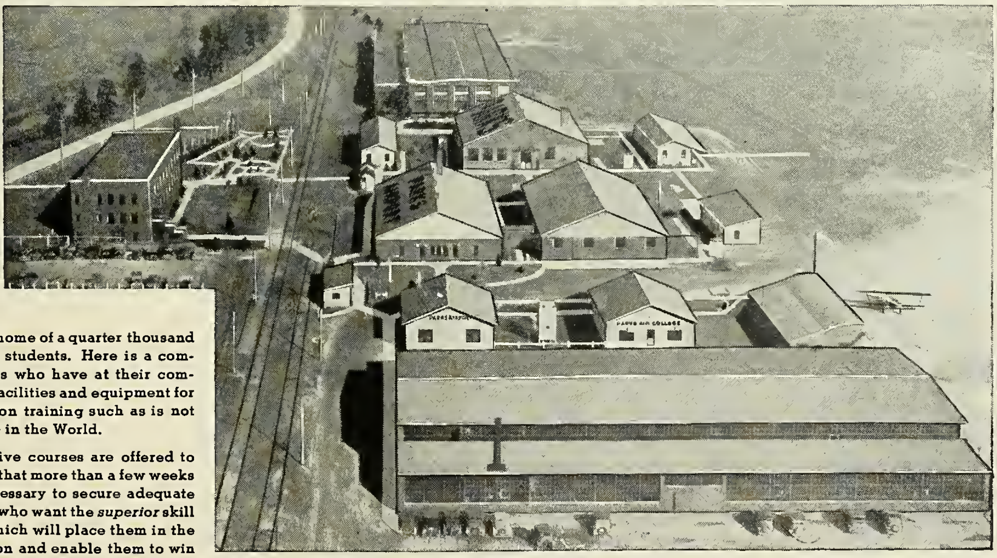
That you want to help build to towering proportions this new transporation service which is making obsolete slow surface travel, and so win for yourself enviable recognition and rewards.

If so, there will be an excellent place for you, an active demand for your services in the piloting, manufacturing, maintenance, engineering or administrative field. The growth of aviation, and the serious shortage of qualified men which has already developed, assure you of that.

But of course, you must be prepared. You must secure the training necessary to make you of value in the field you select. This is where Parks Air College can be of service to you. Parks training, which has already meant success for hundreds of graduates, is available to you, too.

SEND FOR THE CATALOG

You will want to learn all about it—about the curricula, personnel and equipment which, for more than eight years, have commended Parks Air College to men like yourself and have made Parks graduates the preferred men in aviation.



This is the school home of a quarter thousand Parks Air College students. Here is a community of students who have at their command an array of facilities and equipment for commercial aviation training such as is not equaled anywhere in the World.

Here comprehensive courses are offered to those who realize that more than a few weeks or months are necessary to secure adequate training—to those who want the *superior* skill and knowledge which will place them in the front of competition and enable them to win the race for the coveted positions in the years ahead.

It is from this institution that graduates have gone to take their places with air line operators and manufacturers in all parts of the World. These graduates have so proven their worth that executives, keenly alive to the fact that future expansion will require a large number of high calibre men, keep asking for more graduates, often more than are available.

If you want to enter aviation and if you are much in earnest in your purpose to climb above the average, then you, too, will be welcome in this school community.

Fill out and mail the coupon now for your copy of the Parks Air College catalog. It includes the information you want. Your coupon will bring it promptly.

Spring term opens March 30th

PARKS AIR COLLEGE

WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 2-AD

EAST ST. LOUIS, ILL.

Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name______________________________Age______

Address __________________________________

City__________________________State________

CHECK HERE

for special information on the course that interests you:

- ☐ Executive Transport Pilots'
- ☐ Aeronautical Engineering
- ☐ Master Mechanics' Flight
- ☐ Executive Course

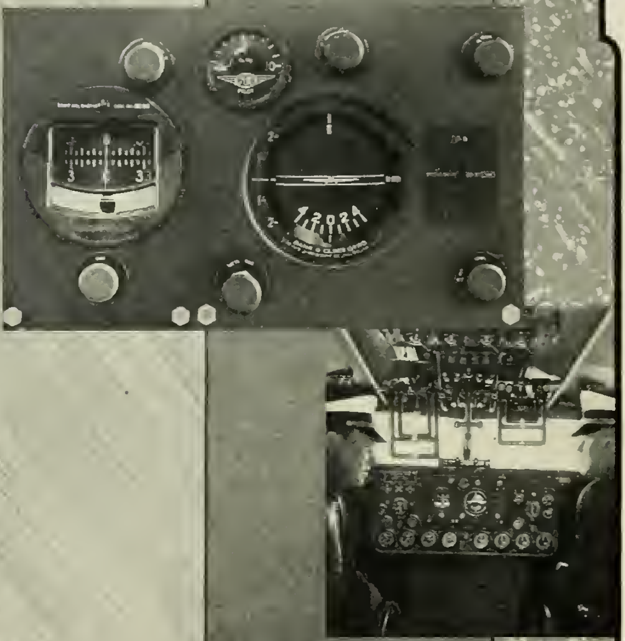
The SPERRY GYROPILOT will see you through . . .

Pouring RAIN

Impenetrable FOG

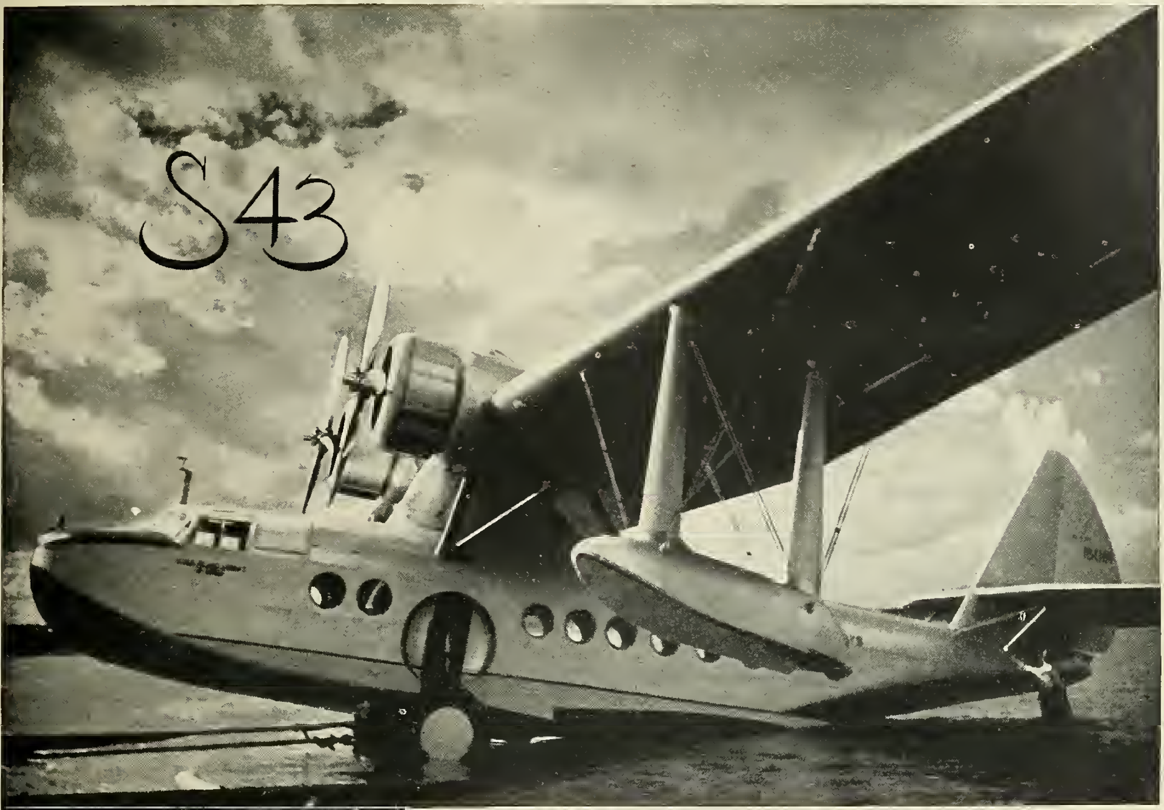
Swirling SNOW

the Black of NIGHT



EVEN in bad weather long flights may be completed with slide-rule precision. The Gyropilot assumes the burden of flying the airplane and makes it possible for the pilots to devote their attention to navigation, engineering duties, radio beam and communications.

SPERRY GYROSCOPE CO., Inc.
BROOKLYN — NEW YORK



In creating the S-43, Igor Sikorsky has given expression to his thirty years of personal experience in practical aircraft designing . . . while at the same time having at his command the accumulated engineering facilities of United.

More Pay Load – More Profits

The outstanding characteristic of the S-43 is its ability to make more money for the operator. For, in this latest Sikorsky airliner, ratio of pay load to gross weight has reached a point far higher than in general transport amphibion practice.

This may well be considered a remarkable achievement, in view of the multiple functions which the S-43 is prepared to perform:

Airport to Airport
Airport to Marine Terminal
Marine Terminal to Airport
Marine Terminal to Marine Terminal

With time-of-elapsed-flight steadily being reduced, time-to-and-from-port becomes more and more important. And, where marine terminals are close to business centers, the S-43 offers an inviting opportunity to the pioneering operator.

Sikorsky

SIKORSKY AIRCRAFT, BRIDGEPORT, CONNECTICUT
Division of United Aircraft Manufacturing Corporation

Dallas Aviation School and Air College

LOVE FIELD *A Government Approved School — Established 1926* DALLAS, TEXAS

These Courses Are Nationally Famous

You Cannot BUY More! , , Why PAY More?

Master Airman and Transport Pilot's Course **$2,590.00**

291 AIR HOURS—6,500 Miles Cross-Country Flying. Time to complete, 44 weeks. 5% discount for cash in full. Travel allowance, cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $600.00 cash, balance in eight equal monthly payments. No notes required or interest charged. Twenty weeks' part time work in exchange for board and room, if desired.

Special Transport Pilot's Course **$1,740.00**

205 AIR HOURS—4,500 Miles Cross-Country Flying. Time to complete, 22 weeks. 5% discount for cash in full. Travel allowance, cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $550.00 cash and balance in three equal monthly payments. No notes required or interest charged. Ten weeks' part time work in exchange for board and room, if desired.

Limited Commercial or Private Pilot's Course **$540.00**

55 AIR HOURS—500 Miles Cross-Country Flying. Time to complete, 10 weeks. 5% discount for cash in full. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $300.00 cash and balance payable in 30 days. No notes required or interest charged. Four weeks' part time work in exchange for board and room, if desired.

Amateur Pilot's Course **$320.00**

27 AIR HOURS—100 Miles Cross-Country Flying. Time to complete, 7 weeks. 5% discount for cash in full. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Two weeks' part time work in exchange for board and room, if desired.

Advanced Aviation and Mechanic's Course **$495.00**

10 HOURS' OBSERVATION FLYING. Time to complete, 44 to 50 weeks. 5% discount for cash in full. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $250.00 cash, balance in six equal monthly payments. No notes required or interest charged. Sixteen weeks' part time work in exchange for board and room, if desired.

Master Mechanic's Course **$320.00**

5 HOURS' OBSERVATION FLYING. Time to complete, 24 weeks. 5% discount for cash in full. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $150.00 cash, balance in four equal monthly payments. No notes required or interest charged. Twelve weeks' part time work in exchange for board and room, if desired.

Advanced Aviation and Mechanic's and Amateur Pilot's Course **$795.00**

27 AIR HOURS. Time to complete, 44 to 50 weeks. 5% discount for cash in full. 10 hours' observation flying. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $300.00 cash, balance in nine equal monthly payments. No notes required or interest charged. Sixteen weeks' part time work in exchange for board and room, if dsired.

Advanced Aviation and Mechanic's and Limited Commercial or Private Pilot's Course **$940.00**

55 AIR HOURS. Time to complete, 44 to 50 weeks. 5% discount for cash in full. 10 hours' observation flying. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $350.00 cash, balance in nine equal monthly payments. No notes required or interest charged. Sixteen weeks' part time work in exchange for board and room, if desired.

Master Mechanic's and Limited Commercial or Private Pilot's Course **$715.00**

55 AIR HOURS. Time to complete, 24 weeks. 5% discount for cash in full. 5 hours' observation flying. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $300.00 cash, balance in four equal monthly payments. No notes required or interest charged. Twelve weeks' part time work in exchange for board and room, if desired.

Master Mechanic's and Amateur Pilot's Course **$495.00**

27 AIR HOURS. Time to complete, 24 weeks. 5% discount for cash in full. 5 hours' observation flying. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $250.00 cash, balance in four equal monthly payments. No notes required or interest charged. Twelve weeks' part time work in exchange for board and room, if desired.

Aircraft Instruments—Radio Service and Repair Course **$795.00**

20 HOURS' OBSERVATION FLYING. Time to complete, 44 weeks. 5% discount for cash in full. Travel allowance, half the cost of a railroad ticket from your home, or port of entry into the United States, to Dallas. Partial payment plan: $350.00 cash, balance in nine equal monthly payments, no notes required or interest charged. Eighteen weeks' part time work in exchange for board and room, if desired.

Complete Classroom and Shop Instruction With All Flying Courses

This School Has:

- 12 good ships, 2 to 14 place, powered with air-cooled motors, 100 to 450 horsepower.
- 5 classrooms—11 shops and laboratories.
- 5 dormitories and cafe.
- Completely equipped machine shops.
- 5 hangars, 55,000 square feet of space for school purposes.
- 10 years of successful operations.

All operations at Love Field, one of the Nation's finest airports

MORE AND BETTER TRAINING FOR LESS MONEY

Mail THIS COUPON

Clip this coupon and mail to us, and we will send you our 60-page catalog and price list.

NAME ....

STREET ....

CITY ....

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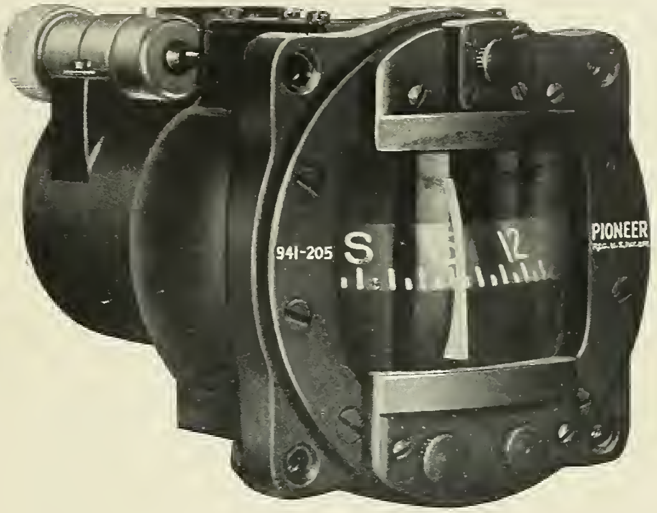
DALLAS AVIATION SCHOOL & AIR COLLEGE

Love Field DALLAS, TEXAS

PIONEER INSTRUMENTS

New!



Pioneer is justifiably proud of Type 941, the latest addition to a long line of successful compass designs. In it we offer you the benefit of sixteen years of experience. Type 941 was designed to meet the most exacting specifications for a small light instrument with performance characteristics previously found only in Compasses of considerably larger size. Outstanding features of type 941 are:

SHORT PERIOD • SMALL OVERSWING • MINIMUM VIBRATION EFFECT • MINIMUM FRICTION PATENTED SPRING CARD SUSPENSION • STANDARD AN-DIMENSIONS • INDIRECTLY LIGHTED FLOAT CARD • CORRECTED FOR TEMPERATURE EFFECT • CYLINDRICAL PATENTED LENS

Compensation... An entirely new principle has been employed in the Patented Universal Compensator giving it distinct advantages over other types. The compensating magnets turn in a horizontal plane which varies the horizontal field only. Compensation by this method has no effect on the performance characteristics of the Compass ∗ Type 941 Compass is one of a group of new Pioneer Instruments. Others will be announced in the near future.

PIONEER INSTRUMENT COMPANY INCORPORATED
BROOKLYN • NEW YORK • A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

GENERAL Headquarters—for Aviation—is found at San Diego. Ryan School of Aeronautics is located at the scene of the most intensive and widest variety of aeronautical activity to be found anywhere in America. Students are in close contact with these important activities:

1. The U.S. Navy's largest flying base, North Island, directly across San Diego Bay, operates continually over 400 planes of every variety.

2. Government aircraft and engine repair shops—largest and finest in existence.

3. The most active aircraft manufacturing area in the world. The factory of the Ryan Aeronautical Company, with which the Ryan School is affiliated, is directly adjacent; and only 100 feet north of the school on Lindbergh Field is the huge new factory of the Consolidated Aircraft Corporation, with over 240,000 feet of floor space; while within a 100-mile radius are located the factories of Douglas, Lockheed, Northrop, Vultee, North American Aviation, Kinner, Solar, Security, and Menasco. A demand by these and other concerns for Ryan graduates greatly exceeds the supply. Why? Because Ryan trained men have proven they are qualified to "fill the bill."

4. Year 'round flying weather. No one appreciates so well as the experienced pilot the advantages to the flight student of maintaining an uninterrupted training schedule. The government flying base was originally established in San Diego on account of its ideal conditions for aviation. This also accounts for Southern California's predominance in aircraft manufacturing activity. Its delightful, semi-tropical weather has brought international acclaim.

A SINCERE COMPLIMENT

The placement department of Ryan has a long list of requests from aeronautical concerns for recommended graduates, which is continually exceeding the number it is able to supply. Ryan training will prepare YOU for one of the many opportunities open for you in aviation!

Right now is the ideal time to start!

5. The Most Important Reason—the superiority of Ryan training. The Ryan School is the oldest aeronautical school under original management; fourteen years of training men for this industry—there is a reason for this record of consistent success. An impelling spirit of progress is the permeating spirit of the Ryan School. Ryan training above all else is sound, thorough, and modern. To make this possible, Ryan has a staff of instructors, every one of whom is outstandingly well qualified in experience and ability. Buildings, classrooms, shops, equipment, and facilities of all kinds are of the finest and meet the needs of modern training for this industry.

Ryan School is known as "America's Most Modern School of Aviation" and Ryan sees to it that this lead is maintained. Still more new buildings, new equipment and facilities have just been added.

Ryan IS the G. H. Q. You will choose most wisely if you select the school that will give you the best training, the most complete foundation and whose graduates have the greatest opportunity of realizing their full ambition in aviation.

Get the complete story on Ryan today. Check the course you are most interested in and full information will come to you immediately.

RYAN SCHOOL OF AERONAUTICS, Dept. AD 2
Lindbergh Field, San Diego, California

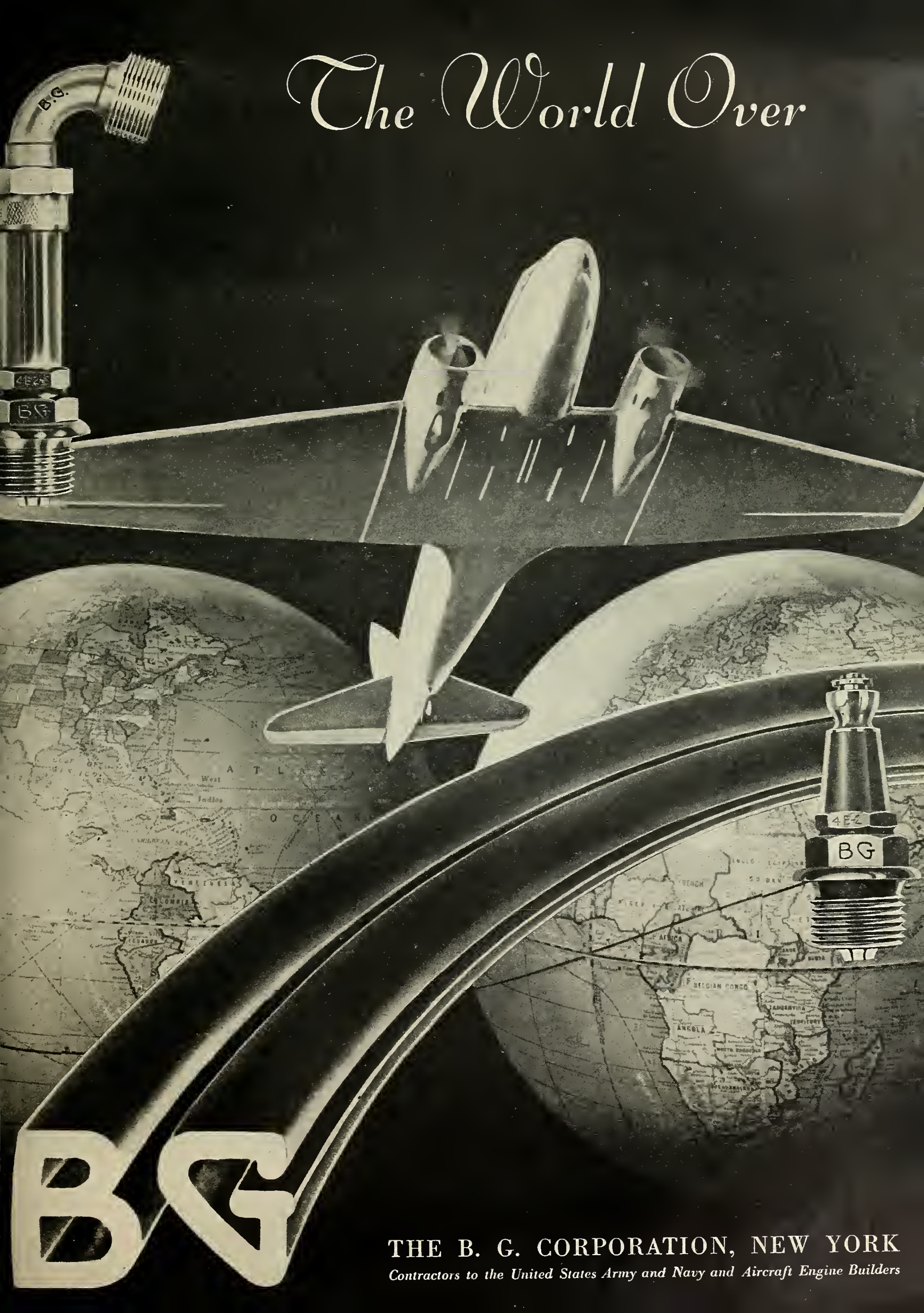
I am interested in courses checked: Please send additional information.

☐ Transport . . $1975
☐ Limited Commercial . . . 585
☐ Private . . . 585
☐ Amateur . . 295
☐ Master Mechanics $550
☐ Weems Navigation 150
☐ Aircraft Welding . 100
☐ Aircraft Radio . . 35

Ryan deluxe Combination Course Transport training plus new Ryan S-T high performance plane 4642

Name____________________ Age______
Address__________________________

RYAN SCHOOL OF AERONAUTICS



THE B. G. CORPORATION, NEW YORK

Contractors to the United States Army and Navy and Aircraft Engine Builders

COMPANION TO THE ELECTRA

DESIGNED as the result of experience gained through millions of miles of airline operation with the Electra, Lockheed announces the new 12—an eight-place, bimotor, all-metal transport of remarkable performance and efficiency.

The new Lockheed 12, which will be available for spring delivery, offers airlines and corporations an economical and completely appointed airplane with every proven safety feature. It is equipped with dual controls, retractable gear, flaps, double rudder and controllable pitch propellers, and the cabin and cockpit are fully soundproofed and ventilated. Its top speed is 231 miles per hour.

The new 12 will be Lockheed's companion-plane to the famous Electra which the factory will continue to produce and which has established itself as one of the world's fastest and most economical airplanes.

Lockheed ELECTRA

	10 A	10 B	10 E
	P. & W. Wasp, Jr. "SB" 450 H.P. @ 2300 R.P.M.	Wright Whirlwind 440 H.P. @ 2200 R.P.M.	P. & W. Wasp, Sr. 550 H.P. @ 2200 R.P.M.
Maximum Rate of Climb, sea level (wheels up)	1,100 Ft./Min.	1,230 Ft./Min.	1,200 Ft./Min.
Cruising Range	690 Miles	680 Miles	685 Miles
Absolute Ceiling (Both Engines)	23,200 Ft.	20,700 Ft.	27,900 Ft.
Absolute Ceiling, full load, one engine	5,800 Ft.	4,000 Ft.	9,000 Ft.
Absolute Ceiling, half fuel dumped, one engine	7,000 Ft.	5,000 Ft.	9,500 Ft.
Maximum Speed at sea level	190 M.P.H.	200 M.P.H.	195 M.P.H.
Maximum Speed	210 M.P.H.	200 M.P.H.	215 M.P.H.
Cruising Speed, at altitude (M.P.H.)	195 @ 9600′	186 @ 7000′	205 @ 9600′
Airplane Gross Weight	10,100 Lbs.	10,000 Lbs.	10,500 Lbs.
Airplane Empty Weight (with Standard Equipment and W. E. 2-way Radio)	6,325 Lbs.	6,300 Lbs.	7,100 Lbs.

LOCK

Lockheed 12

	12 A	12 B	12 F	12 M
	P. & W. Wasp, Jr. "SB" 450 H.P. @ 2300 R.P.M.	Wright R975E3 440 H.P. @ 2200 R.P.M.	Wright R760E3 320 H.P. @ 2200 R.P.M.	Menasco C6S4 290 H.P. @ 2400 R.P.M.
Maximum Rate of Climb, sea level (wheels up)	1,400 Ft./Min.	1,450 Ft./Min.	1,000 Ft./Min.	850 Ft./Min.
Cruising Range	650 Miles	640 Miles	775 Miles	900 Miles
Absolute Ceiling (Both Engines)	27,000 Ft.	25,200 Ft.	21,000 Ft.	18,600 Ft.
Absolute Ceiling, full load, one engine	10,200 Ft.	8,300 Ft.	4,200 Ft.	2,000 Ft.
Absolute Ceiling, half fuel dumped, one engine	11,000 Ft.	9,750 Ft.	5,100 Ft.	3,500 Ft.
Maximum Speed at sea level	219 M.P.H.	224 M.P.H.	202 M.P.H.	186 M.P.H.
Maximum Speed at 5000 feet	231 M.P.H.	221 M.P.H.	197 M.P.H.	195 M.P.H.
Cruising Speed, at altitude (M.P.H.)	209 @ 10,000′	205 @ 7,500′	193 @ 7,500′	182 @ 7,200′
Airplane Gross Weight	7,925 Lbs.	7,925 Lbs.	7,460 Lbs.	7,460 Lbs.
Airplane Empty Weight (with Standard Equipment and W. E. 2-way Radio)	5,355 Lbs.	5,355 Lbs.	4,905 Lbs.	4,905 Lbs.

LOCKHEED AIRCRAFT CORPORATION • BURBANK • CALIFORNIA
New York Office—614 Chrysler Building • Dallas Office—Hangar No. 4, Love Field

HEED

211 miles per hour

SEA
LEVEL

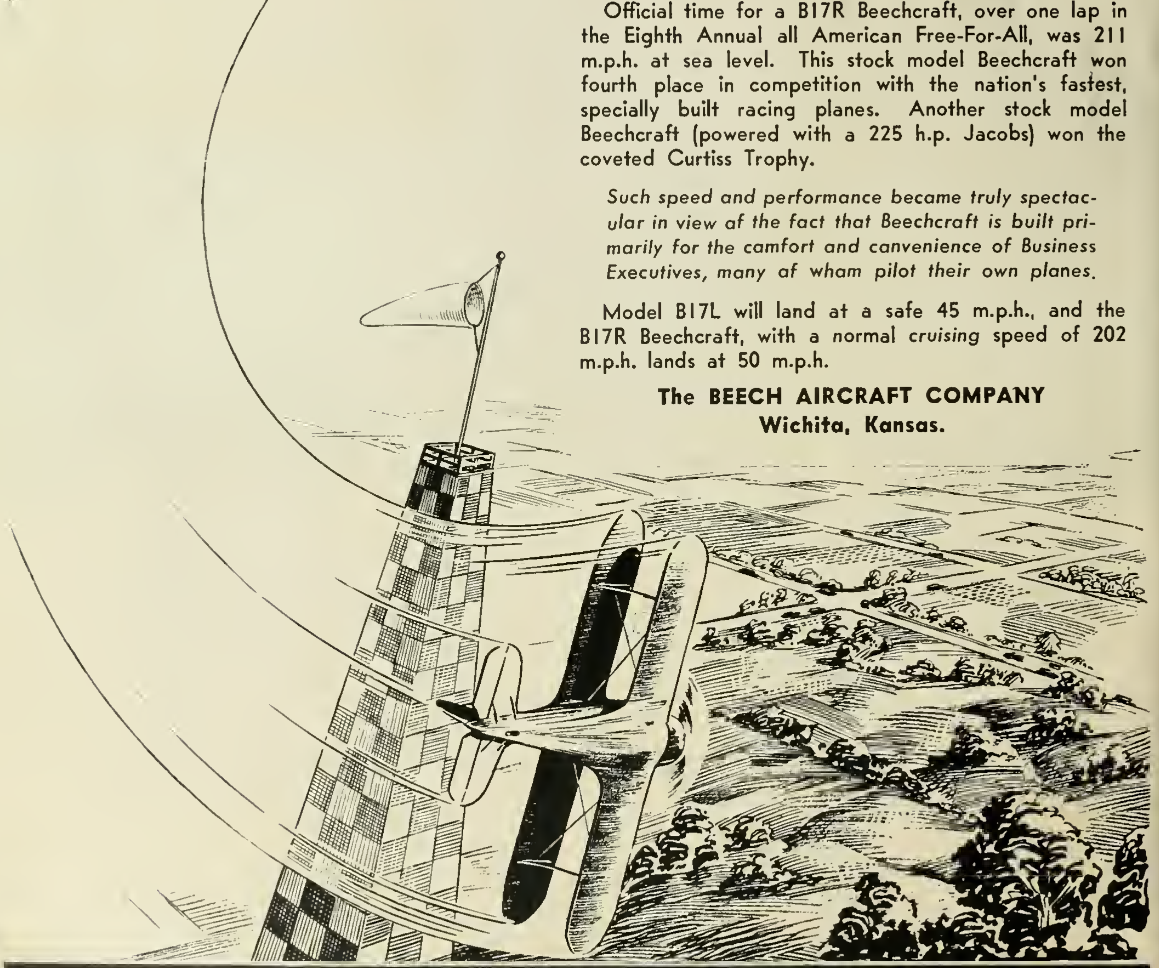
at the MIAMI RACES

Official time for a B17R Beechcraft, over one lap in the Eighth Annual all American Free-For-All, was 211 m.p.h. at sea level. This stock model Beechcraft won fourth place in competition with the nation's fastest, specially built racing planes. Another stock model Beechcraft (powered with a 225 h.p. Jacobs) won the coveted Curtiss Trophy.

Such speed and performance became truly spectacular in view of the fact that Beechcraft is built primarily for the comfort and convenience of Business Executives, many of whom pilot their own planes.

Model B17L will land at a safe 45 m.p.h., and the B17R Beechcraft, with a normal *cruising* speed of 202 m.p.h. lands at 50 m.p.h.

The BEECH AIRCRAFT COMPANY
Wichita, Kansas.



BEECHCRAFT

AMERICAN AIRLINES, INC.

Maintain Schedules with

AERO MOBILGAS!

NEWARK AIRPORT—any weekday—7:15 A.M.—American Airlines' Aero Mobilgas truck has just finished fueling the "Early Bird" efficiently, quickly, for her hop to Boston.

From now till the "Night Owl" takes off for Chicago at 1:00 A.M., eighteen more of the popular departing American Airliners will be refueled with Aero Mobilgas.

•

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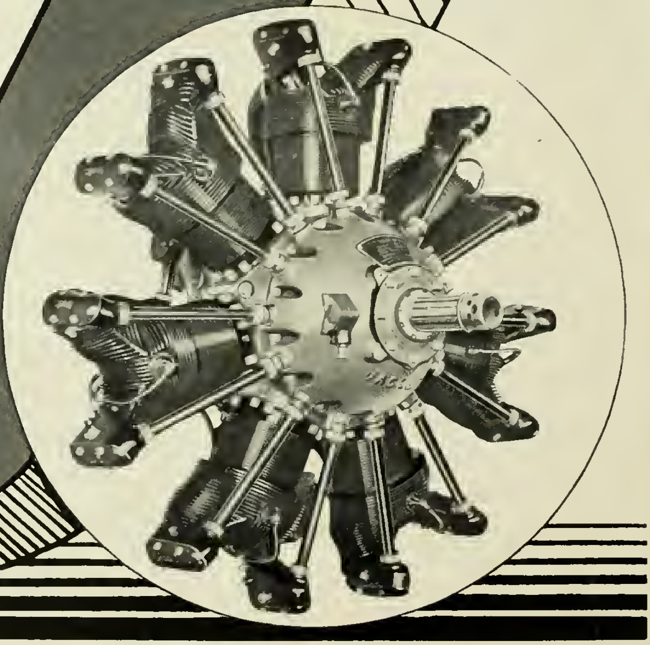

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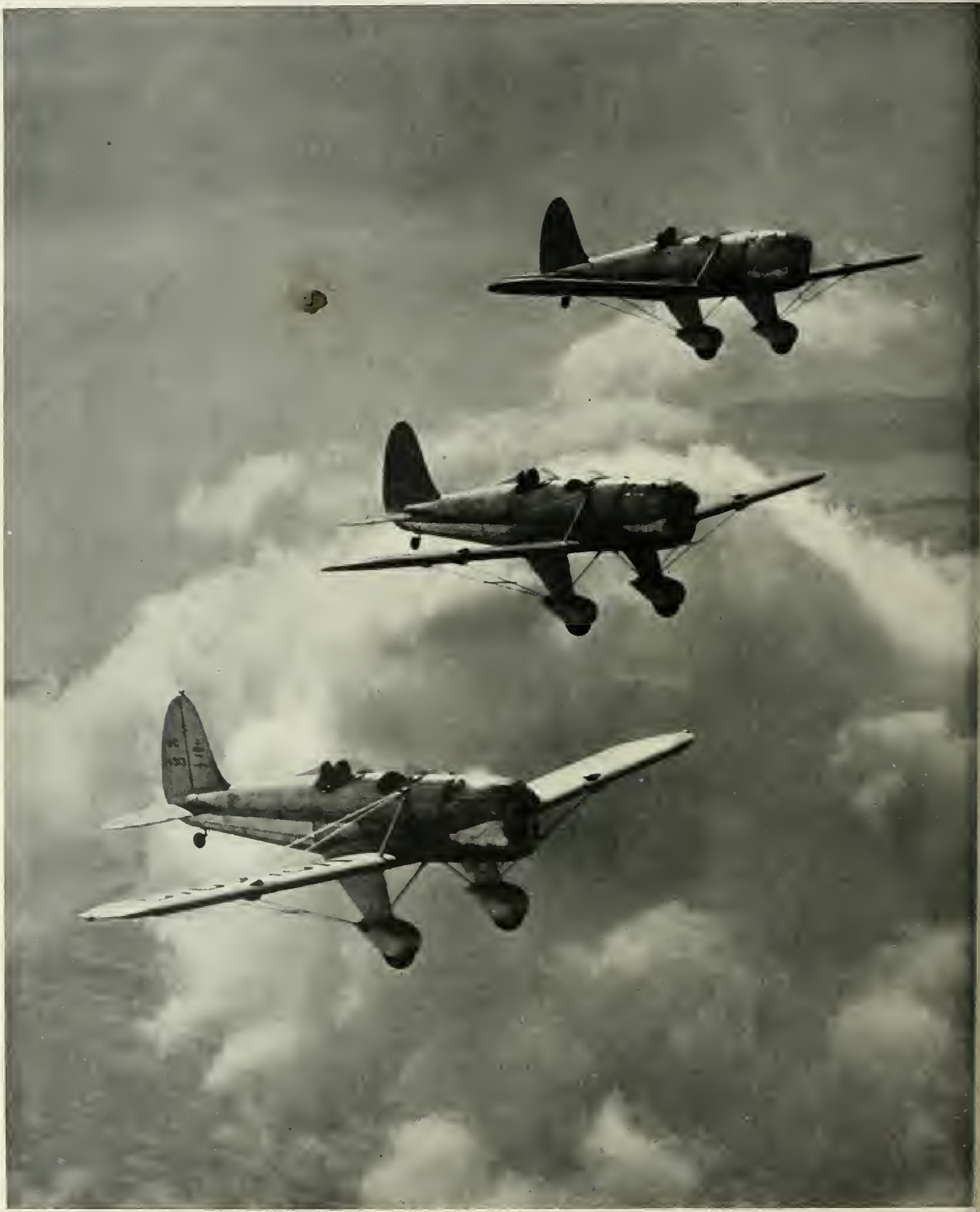


Photo by Erickson

Flight formation of group of Ryan S-T sport planes over San Diego. These metal fuselage two-seater monoplanes, powered with the inverted Menasco B4 engine of 95 h.p. have a high speed of 140 m.p.h.; with the Menasco C4 engine of 125 h.p., the high speed is 150 m.p.h.

AIR
HOT AND OTHERWISE

●

FRANK A. TICHENOR

● In spite of all the pros and cons regarding the value to individual aviation companies of aircraft exhibitions, they do offer the aircraft industry an opportunity to pause and take stock of itself. This is true not only in the sense that the show assembles under one roof all the evidence of our technical progress.

It is true, also, in the larger sense that our technical achievements give us some hint of where aviation stands today in the world picture and where it may be heading in the future.

Ever since the day the first man went up in a balloon, in France during the eighteenth century, there have been all manner of extravagant predictions as to how aviation would affect the affairs of mice and men. Few of those predictions have yet been realized, except in mild form. As a result many of us—even those whose faith in aviation is unbounded—have gotten into the habit of ignoring, if not subconsciously scoffing at, such prophecies. To be sure, we continue to believe in the manifest destiny of aviation. We are convinced that aviation will some day change many of the methods of mankind, that it will alter the way wars are fought, that it will revise the channels of commerce, that it will influence the trends of international diplomacy and that it may change the map of the world—eventually. We will even admit that it is doing some of these things already, to a moderate degree. But on the whole we think of these things as events in a dim future. We are so busy tending to our daily knitting that we don't give more than a passing thought to the great rôle aviation must inevitably play on the world stage.

It's time we awoke—for the curtain is rising. All these years aviation has only been rehearsing its part. Now it is ready to step out from behind the wings into the spotlight of world affairs.

We cannot any longer afford to ignore the old predictions. They are too close at hand. They may have crept up on us when we weren't watching, but they are here. Make no mistake about that. Are they going to catch us napping? Or are we, as Americans and members of the aviation industry, going to measure up to the responsibility they impose upon us?

* * *

Just what is that responsibility? Briefly, it is to leave no stone unturned, to allow no obstacle to stand in the way of our developing American aviation to the greatest among all nations of the world. Not as a matter of national pride, but as a matter of national necessity.

The world is on the threshold of perhaps the most drastic change in the annals of mankind. The history of nations since the Middle Ages has been a history of the sea. The strongest maritime nation has held the key to the world.

But the era of the sea has passed. The era of the air is here. That is not just idle eloquence. The evidence is on every hand. To anyone who takes the trouble to look behind the smoke screen of Europe today, it is clear that it is the air which now holds the balance of power.

If this is not so, why then have the sanctions against Italy not been enforced to the last drop of oil? Why, when the most powerful naval fleet in the world is standing by in the Mediterranean to insure the enforcement of the sanctions? Simply because, however powerful that fleet is in surface craft, it is weak in aircraft. Against its few hundred planes, Italy has 4,000 within striking distance. Those 4,000 could destroy that great fleet, and every diplomat in Europe knows they could. And those 4,000 planes are writing history in a new hand.

That is not the only case in point. Another is Russia. The Communists may blame the Czars for Russia's backwardness up to 1917, but they know full well that perhaps the biggest reason Russia did not rise to the heights of a great world power was that she was landlocked—almost entirely without satisfactory seaports. And they know equally well now that that geographical handicap is doomed—as soon as they have built up the air power of Soviet Russia second to none. That is the reason for all their feverish activity in aviation, the reason for their feverish air propaganda among the Russian people, their intensive training of pilots, their energetic building of planes. Russia wants air power, not as most of us have supposed, to carry the firebrand of Communism throughout the world, but to weld together her own vast domains and free herself forever from the shackles of the sea. She is acting now upon the day when a seaport will mean far less than an airport. For she knows that the balance of power is in the air.

* * *

There is no need to cite further evidence in point. There is no need to analyze the significance of Germany's present activity in aviation, or France's, or a suddenly awakened England's. The handwriting is on the wall, and the government of every nation seems to see it—except our own prize cageful of New Dealers.

It is too much to expect that they will see it. Old-line Navy men don't want to see it, and the New Deal has Barnacle Bill the Saviour at its head. So the responsibility is directly up to those of us who comprise the aircraft industry. We must not, we cannot let America slide into second place in the air. We must fight tooth and nail against the restrictions and the obstructions of a benighted, meddling Government. We must work not only to create the most effective, if not largest, air force in the world. We must work also toward those broader goals—the most efficient air transport operations, the most extensive private flying and the most healthy aircraft manufacturing industry in the world.

* * *

Mark you well just one fact:—While every other important government is doing everything within its power to encourage aviation, ours alone continues to drag it through the mires of Government meddling, political ignorance and over-regulation.

Only eternal vigilance on the part of the industry can save American aviation from the life-sapping effects of Government interference. That means not only deliberate interference as in the case of Patronagemaster General Farley's air mail episode, and dunderhead meddling in the domain of private enterprise as in the case of Mr. Vidal. It means also ignorant strangulation as in the case of the President's neutrality policy. Possibly no act of the New Deal to date has been so half-baked and so potentially dangerous to the nation's welfare as this neutrality policy. Based upon the already discredited notion that munitions manufacturers foment wars, it goes even beyond the munitions manufacturers and clamps restrictions on the manufacturers of strictly civil aircraft and aircraft parts. By demanding a $500 licensing fee, it threatens the very existence of some of the smaller ones.

That would be reprehensible in normal times. It is intolerable when the thunder of war is already sounding on the European horizon and America is depending upon the thin thread of another New Deal experiment to keep us out of it. It seems almost inconceivable that any government could be so abysmally stupid as to choke the very breath out of the industry which must be its mainstay and support in case that experiment fails like all the others and we are dragged into war.

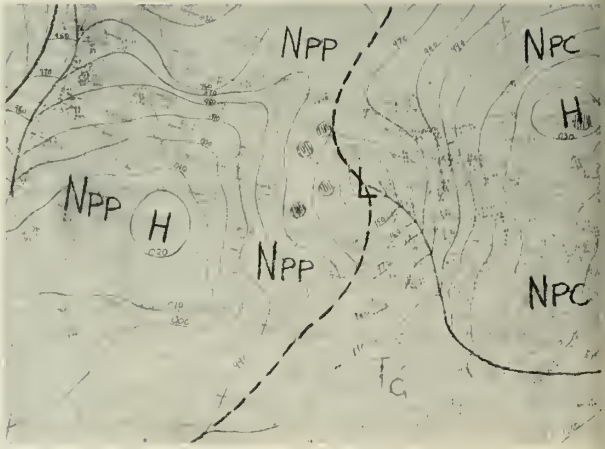
The New Weather Science

One of a series of articles on the subject of Flying Weather

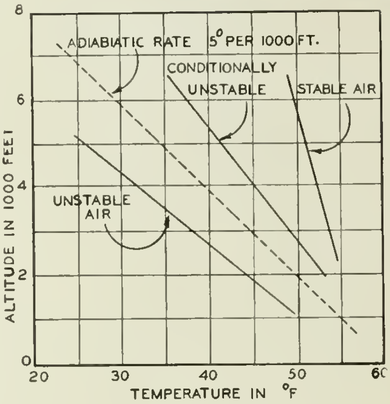
●

WILLIAM H. WENSTROM

Captain, U.S.A., Meteorological Officer for
Bolling Field, D. C., and Third Corps Area



Portion of a weather map of N. America



SIGNIFICANCE OF THE SLOPE OF THE TEMPERATURE–ALTITUDE CURVE

● An important phase of aviation progress is the increasing knowledge of weather. No small part of this progress is due to developments in meteorology. On the most advanced airlines this new weather science is applied to flight problems hourly by meteorological specialists, and every pilot is required to master its fundamentals to the extent of understanding the weather analyses and forecasts made for him, and making forecasts of his own. If such weather knowledge is essential to the transport commander, riding a ten-ton ship equipped with every navigation aid and talking half-hourly to his terminal, it should be as useful to the itinerant flyer, who often has to make his own weather decisions.

The new meteorological ideas have been heralded under a variety of names, of which "polar front theory" and "air mass analysis" are the most common. More accurately descriptive, perhaps, are "air-mass-and-front analysis" and "physical weather analysis."

The rise of air-mass-and-front analysis does not mean, as newspaper stories sometimes indicate, that other ways of looking at the weather are valueless or obsolete. No *physical* principles proved in traditional meteorology are invalidated by recent developments; rather, they are elaborated and confirmed. And the basic ideas behind air-mass-and-front analysis are not exactly new.

Air mass analysis might be said to have begun with vertical temperature soundings made by kite in the eighteenth century. During the nineteenth century, large opposing currents of dissimilar air in the cyclones of temperate latitudes were noticed by various European meteorologists—Dove in Germany, Fitzroy in England, Siljeström and Lilliehöök in Sweden. This idea of conflicting air currents, further developed around 1900 by Bigelow in the United States, is the germ of the whole "polar front" theory. But chief credit for the systematic building of all these early ideas into the unified and workable whole of modern air-mass-and-front analysis must go to a few weather analysts in Norway—Bjerknes father and son, Solberg, Bergeron and others—whose work reached practical importance about 1918, and continues at the present time.

The Underlying Principles

Air-mass-and-front analysis is based on five main ideas, as follows:

When air stagnates for some time over a distinctive geographic area, called a source region, it acquires characteristics, such as temperature and moisture, in keeping with the prevailing climate of the source region. For example: "polar" air is relatively cold, "tropical" air is relatively warm, "continental" air is relatively dry, "maritime" air is relatively moist. In general these characteristics are not limited to air near the surface, but extend several miles aloft.

Impelled by the general atmospheric circulation, large masses of air (hundreds of miles across and several miles deep) may travel long distances over the earth's surface, still retaining in some degree their source region characteristics, which are modified only gradually as the air mass sojourns in a new geographic region. This modification is usually accomplished first at the surface, later aloft.

When two dissimilar air masses are brought together by the general atmospheric circulation they do not immediately mix; a definite boundary or discontinuity zone (perhaps five or more miles wide) occurs between them. Along and near the boundary, colder (denser) air always underlies warmer (rarer) air in the form of a wedge; hence the front between the warm and cold masses (actually a mixing zone but pictured and spoken of as a discontinuity surface) is usually inclined at a small angle to the earth's surface.

Definite interactions (producing clouds, rain and other weather phenomena) occur along these fronts. The form and intensity of these interactions depends on the differences in characteristics of the dissimilar air masses involved, their ex-

U. S. Army Air Corps photo

Typical scattered cumulus clouds, having flat bases at condensation level

U. S. Weather Bureau photo

Alto-stratus cloud above with scud clouds coming up below, just before the rain

ent, and the rapidity with which they are brought together.

In addition to this frontal weather, clouds, rain and other weather effects may occur within air masses where the characteristics of the air mass itself favor them, and where terrain features and the motion of the air mass accentuate these characteristics.

The accompanying weather map shows some of these large air masses playing their part in the American weather scene. The air over the eastern states, marked Npc, has drifted south from Canada. The western part of the country is covered with air that came from the Pacific Ocean, marked Npp. The southern air mass, marked Tg, has drifted up from the Gulf of Mexico. The heavy lines on the map show the fronts, or boundary surfaces between these unlike air masses. Most of the rain and bad weather being felt in the country, indicated by shading, is occurring along or near these fronts. The front extending from the low in southern Minnesota southeast through Illinois is called a warm front; here warm air is capturing territory formerly held by cold air. The broken-line front extending south from the low towards Oklahoma, on the other hand, is called a cold front; here cold air is capturing territory formerly held by warm air.

This surface weather map is one of the forecaster's principal tools in weather analysis. The base map shows the main outlines of North America (or any selected region) together with the general topography. Around the circle representing each observing station are plotted the temperature, pressure, wind direction and velocity, state of sky and weather, and other data. Isobars connecting points of equal pressure, fronts between air masses, and other formations are drawn during the analysis. Upper winds at various levels are sometimes drawn on the surface map, but more often they are represented on a separate upper wind map that is also used in the analysis.

Before discussing in detail the cyclone structures, fronts, air masses and attendant weather phenomena that enter into physical weather analyses, it may be well to examine briefly some fundamental relations in the general physics of the atmosphere. Though perhaps a trifle tedious, they are necessary to understanding.

The ocean of air in which we live is composed of about 20% life-giving oxygen, about 80% inert nitrogen, minute proportions of several rare gases, and a variable amount of water vapor. The water vapor plays such an important part in weather that it will be worth while digressing for a moment to describe its functions more fully. The amount of it in the air varies from a trace up to about 4% by volume or 2.5% by weight. In any given air mass the amount of water vapor present is best indicated by specific humidity, usually expressed in grams of water per kilogram of air. Specific humidity varies from less than 5 g/kg in dry, cold air up to 15-25 g/kg in warm, moist air. And for every temperature, there is a corresponding saturation specific humidity: (for example, 3.5 g/kg at 32° F., 14.6 g/kg at 68° F.). If the amount of moisture in the air at a given temperature reaches this saturation value (in other words if the relative humidity reaches 100%), or if an air mass having constant specific humidity cools until the saturation temperature, or dew point, is reached, water vapor begins to condense in the form of minute droplets of liquid water. The nearness of the relative humidity to 100% and the nearness of the dew-point to the actual temperature are thus both measures of the imminence of condensation.

Nuclei, such as particles of dust or salt, also necessary for condensation, are normally present in an air mass. Given such nuclei, high relative humidity and a falling temperature, condensation will occur when the temperature reaches the dew-point. If this condensation occurs near the ground, it takes the form of fog; if it occurs aloft, clouds are formed. If condensation goes far enough, the minute cloud droplets coalesce into much larger drops (particularly if minute ice crystals are present, as they usually are in the higher clouds, to serve as nuclei for this larger condensation), and these larger drops fall groundward in the form of rain. If temperatures are below 32° F., the result may be snow or other ice formations.

U. S. Army Air Corps photo

Deck of low stratus and strato-cumulus clouds with high cirro-stratus overhead

Pressure in the air ocean of course varies inversely with altitude, decreasing fairly uniformly in the lower levels (about 1 in. per 1000 ft.). Temperature also decreases, on the average, as one goes higher (about 3° F. per 1000 ft.). However, this average temperature decrease is seldom matched in an actual air mass; temperature may decrease much more sharply, it may remain constant, or it may even increase with height.

We have seen that cooling of humid air produces condensation—clouds, rain, and the like. This cooling is usually brought about in the upper air as the air is cooled when forced to rise. As any sample of air ascends, the pressure around it decreases, hence the air sample expands, hence cools. If it neither loses nor gains heat from external things, it is said to cool adiabatically. The adiabatic cooling rate of ascending air (without condensation) is about 5° F. per 1000 ft. of ascent. If condensation occurs the rate of cooling is somewhat less, as the latent heat of condensation is released. This adiabatic cooling rate is one of the fundamental facts of physical meteorology.

At a given pressure, cool air is rela-

U. S. Army Air Corps photo

Cirrus and cirro-cumulus clouds lie far above ordinary flying levels

AERO DIGEST *photo*

Alto-cumulus clouds about 5000 ft. above the "China Clipper" flying at 7000 ft.

tively dense and heavy, and warm air is relatively rare and light. This relation leads to the important idea of the stability of an air layer. In a layer having a vertical temperature gradient equal to the adiabatic cooling rate (—5° F./1000 ft.), a rising sample of air would find itself always at the same temperature as its surroundings. In an air layer having a temperature gradient considerably less than adiabatic—say the average gradient, —3° F./1000 ft.—a rising sample of air would become cooler (and denser) than its surroundings, hence would tend to sink, and therefore would never rise in the first place. Such a layer is said to be stable. If an air layer has a temperature gradient much greater than adiabatic (say —8° to —10° F./1000 ft.), a rising sample of air would rapidly become less cool (and less dense) than the surrounding air, and would continue to rise. Such a layer is said to be unstable. If an air layer has a temperature gradient equal to or only slightly less than the adiabatic (normally neutral or stable), and also has a high relative humidity, condensation may start, and released latent heat may serve to keep the air sample rising. Such a layer is said to be conditionally unstable—that is, it may become unstable if condensation starts.

Unstable air will not begin overturning on its own account unless the temperature gradient is excessive (about —17° F./1000 ft.), but it will continue to overturn if triggered off by ordinary atmospheric occurrences such as upward wind components above mountains, intense surface heating by the sun, etc. The practical significance of instability is that, in any air layer which is unstable or nearly so and also characterized by high humidity, then clouds, rain and other bad weather are likely to form on the slightest provocation. This is particularly true around mountains where both upward wind components and excessive surface heating are common. Even stable moist air, if lifted far enough by external forces, will form clouds; it may, for example, be forced to rise by reason of its horizontal motion along the upper surface of a wedge of colder air, forming clouds of the flat, layer-like type. And unstable air may need only slight initial lifting to start its own vertical currents, which usually result in clouds of the puffy, wool-pack type. The more unstable the air, the more moist it is, and the more violently it is lifted by external forces, the greater will be the bad weather effects in clouds, rain, snow, hail, and the like.

Nature conducts all these meteorological experiments on an enormous scale. Even a local summer shower involves millions of tons of air, hundreds of thousands of tons of water, and energy equivalent to the burning of thousands of tons of coal. A widespread storm, such as occurs along a well-marked front, involves materials and forces many hundred times greater.

Cloud Forms

While clouds take many forms, most of them can be classified under four main types: stratus, cumulus, nimbus, and cirrus. The types of clouds present in the sky are often closely related to the existing weather situation; and serve to distinguish, particularly, between typical warm front and cold front conditions.

Stratus clouds are flat and layer-like, extending horizontally rather than vertically. They represent stable air conditions, without much vertical convection, and are usually associated with warm fronts. Occasionally they occur at low altitudes in a warm air mass, taking the form of fog. Their height varies greatly: they can occur at all levels between the surface and about three miles aloft.

Cumulus clouds are piled-up and puffy in appearance, resembling wool-packs or cauliflowers. They extend vertically rather than horizontally, and represent unstable air conditions, usually occurring along cold fronts and within unstable air masses, particularly when solar heating is intense. The height of their bases is often around 2000 ft., though it may be much higher. Their tops are usually below 15,000 ft., though in the form of overgrown thunderstorms they may occasionally extend to 25,000 ft., or even higher. In a warm, moist (tropical maritime) air mass large cumulus clouds usually develop during the morning, growing into thunderstorms in the afternoon.

The term nimbus is applied to any cloud from which precipitation—rain, snow or the like—is falling. In the region of heavy rain or snow, the cloud is usually a large, irregular mass, but elsewhere it may take either stratus or cumulus form, depending on the stability of the air mass involved.

Strato cumulus clouds are, as the name implies, a combination form. The individual clouds resemble rather flat and thin specimens of the cumulus type, often woven loosely together in some semblance of the typical stratus layer (but usually separated from one another by small breaks). Strato-cumulus may also occur as detached, scattered clouds. Alto-stratus and alto-cumulus are higher forms of the two basic types, occurring at altitudes of two or three miles.

Cirrus clouds (also cirro-stratus and cirro-cumulus) are relatively thin and white in appearance. They occur far above ordinary flying levels at heights of five to seven miles, and consist of innumerable minute ice crystals. The true cirrus, or mare's tails, are fibrous in appearance and stream out in the direction of the upper winds.

The Music Goes 'Round and Around—

CY CALDWELL

● Nearly everybody in Washington is slightly cracked, or they wouldn't be in Washington. They may come here practically sane, but the pace gradually gets them. For instance, I've been here only a couple of days, and already I find myself slipping. Just as I sat down to my little typewriter in my little hotel room I heard a strange rumbling sound. I investigated and suddenly discovered that I had been muttering to myself. I am not perturbed, for I know that I am merely going native, and the mood will pass when I return to the United States. That D.C. they put after the name of this city means Demented Center.

I've been looking into this recent election in the National Aeronautic Association, and have arrived at two contradictory conclusions. (1) The old reactionary gang had been thrown out, and a new group of progressive citizens had taken control. (2) The stalwart, old group have been thrown out of the NAA and a new gang has seized control.

I have also discovered that the new progressive group in the NAA unanimously elected as president that noble, red-blooded patriot, Mr. Charles F. Horner.

I've never had any use for the policies that have controlled the NAA during the last ten years,—as I have indicated from time to time. The NAA has been a political publicity and social tool for anyone who had enough money to get himself elected president. My opinions of ex-Senator Hiram Bingham are sufficiently well-known to render it unnecessary for me to repeat them here. As for Senator McAdoo, he spent a year as president, gave out what is sometimes referred to as a clarion call to the industry, and then went off and got himself married.

While McAdoo was making arrangements to spend his declining years on the Honeymoon Express, he paused long enough on the Road to Romance to appoint a Mr. Charles F. Horner, hitherto unknown to the aviation world, as executive assistant to the president of the NAA. Mr. Horner organized some 600, more or less, business men's committees throughout the nation, and set them to work whooping it up for aviation.

Now, I have heard sullen rumblings about the convention which elevated Mr. Horner to his present precarious position on the aeronautical perch, and in my fumbling way I have tried to get to the bottom of the matter.

The first person upon whom I called was Mr. Horner, personally a charming individual. He is, to put it plainly, an Old Smoothie. Under the supposition that you can catch more flies with honey than you can with vinegar, it is my impression that Mr. Horner is an experienced fly-catcher from away back, for he is simply dripping with sweet nectar. As I am an Old Roughie, from almost as far back, we were pretty evenly matched. I brought up some of the matters that had been troubling me in my sleep, such as his absence from Washington, where he was supposed to be running the NAA, and his presence in New York for two and a half months last year, from August 1 to October 15, when he was *also* employed by an association of boondogglers known as the Works Progress Administration, or WPA under General Hugh Johnson.

Mr. Horner, the Old Smoothie, explained this affair in elaborate detail. He had been retained by Senator Honeymoon McAdoo, he said, only on a part-time basis. He was to receive a "drawing account" of $500 a month for guiding the NAA in the way in which it should go, but he was not to be hampered in any other patriotic activities into which his warm and generous heart should lead him. General Johnson, he said, had sent out a hurry call for aid, lost as he was on August 1 among the terrible Tammany tigers of New York. He needed help, did the General in the Tammany jungles, and to whom could he apply but to Mr. Horner, the Old Smoothie. Mr. Horner heard this call and, like Livingstone hastening to the succor of Stanley lost in the wilds of darkest Africa, hastened to the aid of Johnson, lost in the wilds of darkest America. For two and a half months Mr. Horner battled his way through the jungles of New York, at an honorarium (or salary) of $20 a day, paid by the WPA.

I pointed out to Mr. Horner that I considered it somewhat unethical of him to be accepting a drawing account, (or whatever you call it) of $500 a month from the NAA while doing no work for the NAA. Mr. Horner was indignant. He toiled, he said, while his comrades slept. Not for him the eight-hour day. At times he would start from his sleep, bursting with thoughts about the NAA and the good of aviation. Even in New York, lost to aviation and the civilized world for 10 weary weeks, the good of aviation was ever in the back of his head. Sometimes he even dragged it out to the front of his head, making his forehead bulge to a somewhat alarming degree. If his absence was all right with Senator McAdoo, he said, why was it not also ok with me? I murmured something about a salary, and earning it, but he dealt me the withering reminder that he was not on a salary, but on "$500 times the number of months he works for the NAA." Even so, I suggested, there were some 2½ months when he had *not* worked for the NAA, but for the WPA.

As for the man's qualifications for the position of president of the NAA I asked him what aeronautical qualifications he had for the post. What did he know about aviation? Nothing, he said at once. Then, said I, $500 a month is too much to pay for nothing. Well, he said, he didn't pretend to know *much* about aviation, but he knew something. I pointed out that anyone who read the papers could hardly avoid some little knowledge of aviation, but I couldn't see where that little was worth $500 a month.

Mr. Horner's background is an interesting one. As he holds the dazzling position of president of the NAA you might naturally suppose that he had worked in aviation, and thus, like Horatio Alger's heroes, had forged to the front. But he

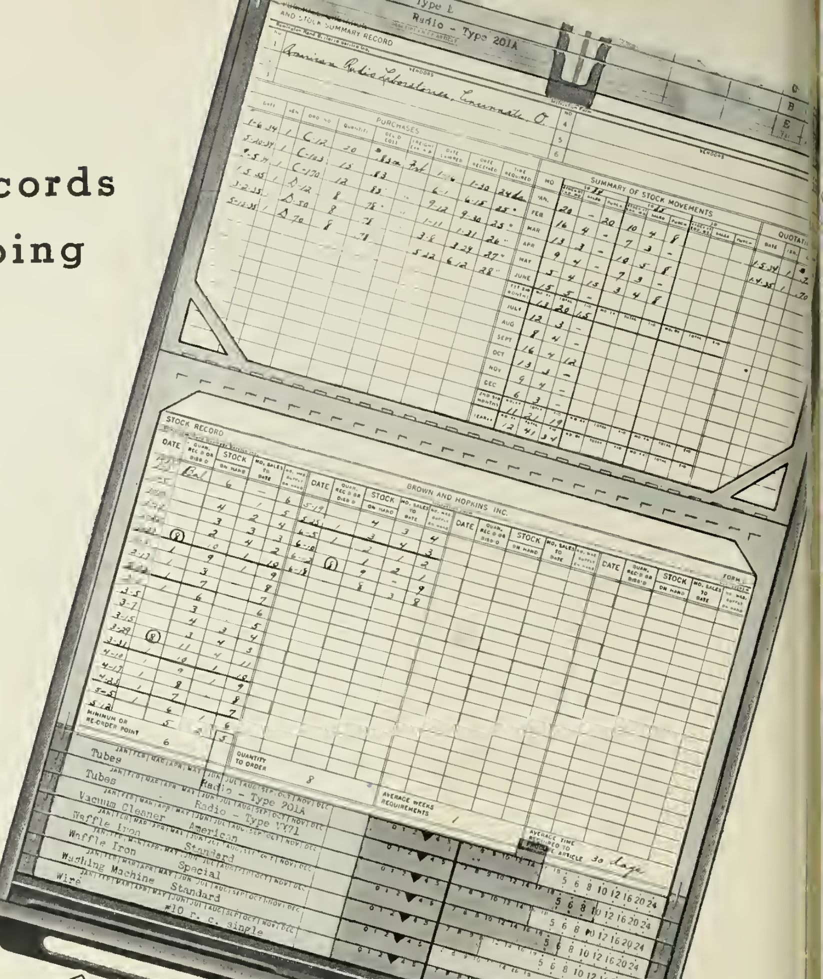
(*Continued on page* 82)

Standardized Records and Record-Keeping

●

LEWIS CRUIKSHANK

Systems Div., Remington Rand, Inc.



● Reading through the pages of a catalog of a general aviation supply company it is surprising to discover that on the one full page devoted to FORMS, Pilot's log book is all that is found there. That is all there is today in the way of a standard form for the entire industry. Think of it! After twenty odd years of business and no forms that can be ordered to cover a situation.

There is an expression, "A company without its records is like a man without his memory." How true and how noticeable that is when one travels around through the aviation industry to find that 90 percent of those who should be held responsible for this branch of any business actually are laboring under such handicaps of antiquated hand-drawn forms and papers that it takes hours and sometimes days to draw off a survey on the report of conditions in practically every department of their company.

It is evident that while technical progress is on the threshold of a new era, records and record keeping should be standardized in order that one company may gain knowledge from another that has profited through the experience of an all-too-long period of transition. Countless companies in the automobile industry went through that same trying period, but now standardization of forms for all is a matter of record. So it shall be in the aviation industry.

This, the first of two articles, deals with stock records and equipment necessary to house those records.

Transport Operations

A scientifically drawn form for one company may not fit all the requirements of another company in a different branch of the industry, but on the whole, similar companies can glean many ideas from

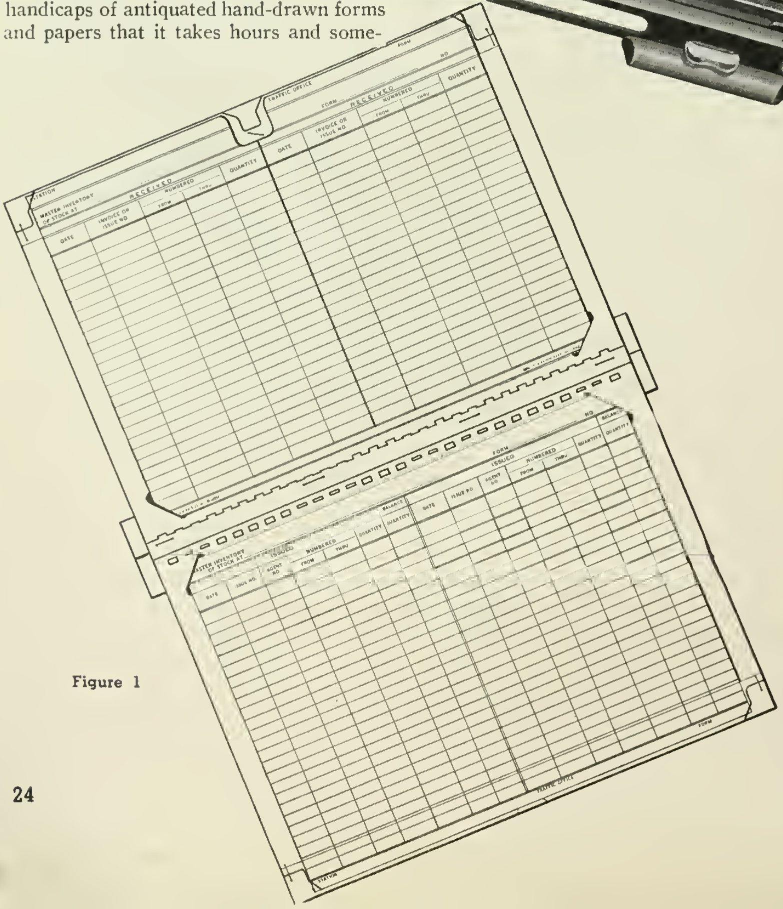


Figure 1

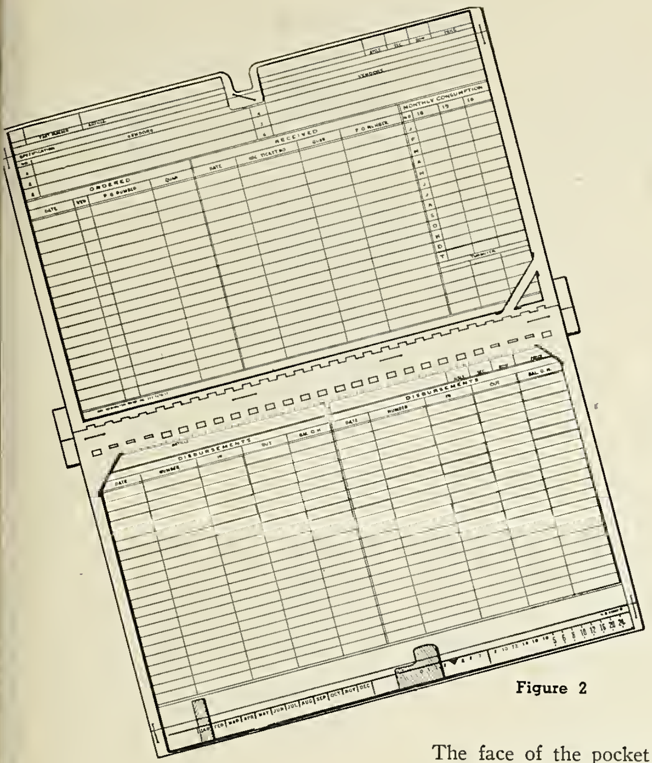


Figure 2

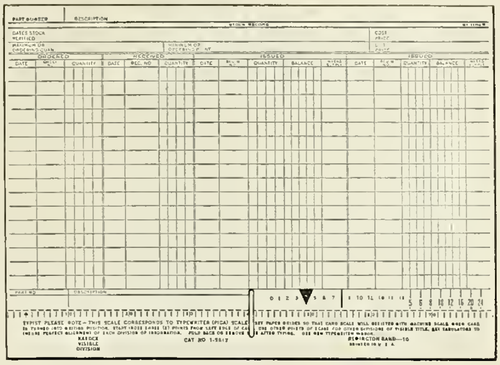


Figure 3

figure 1 on the opposite page.

This is a Kardex pocket with a card in the face of it and a card in the back of the pocket above it. This Master Inventory Control, used by one of the largest transport companies, gives the head office a general picture of the movement of stock, parts and material at all maintenance locations. The card in the back of the pocket shows what material is received from a vendor, and the face of the pocket card shows the disbursements.

The ¼ in. or ⅜ in. visible margin on all Kardex equipment is one of the most valuable points to consider in setting up a record. The control of that record depends on what you can see in that space. On the above record, all that is necessary to know is the Station and the Traffic office. This is true for when the company comptroller calls for an inventory report of Salt Lake City operations one has merely to flip up the pocket "Salt Lake" (alphabetically arranged) and there you see it; but when there is a maintenance field at Lincoln which may be handled by the traffic office Chicago, one has also to look for this traffic operations point in order to draw off a proper report.

In figure 2 the card in the back of the pocket is a purchase record with space for a record of monthly consumption. Visibility is given to part number, article, aisle, section and row where part is located in the bin type steel shelving and the price last quoted for that part.

The face of the pocket card again, as in all Kardex stock records, shows disbursements. The interesting point in this illustration is the use of the progressive (sliding) signal which comes to rest over the scale showing the balance of this material on hand. The title insert used in conjunction with this signal is so marked that when the signal recedes to the ordering point, it immediately flashes to the attention of the purchasing agent. In the case illustrated, we find the signal below the ordering point so our eyes glance to the left on that item to find the small signal which automatically says, "This is on an order." If there is no signal placed there, immediate action must be taken to forestall "out of stock" conditions.

Stock on hand is something that every company must consider carefully, for in the manufacturing industry, the modern business axiom states that "a penny of waste saved, is a penny of profit earned."

Enormous funds are tied up in carrying an over-supply of slow-moving stock. Profits are made in the rapid turnover of stock. Consider for a moment the movement back and forth of this signal; if it is known that it takes four weeks to receive material from a manufacturer, it is logical that eight weeks' supply on hand should be the ordering point, for delays are bound to happen.

To obtain a minimum turnover of six a year, assume that an order is placed for eight weeks' supply at that time. Now assume that in four weeks (or when we are down to four weeks' supply on hand) the shipment is received. This automatically sends the signal back to twelve weeks' supply on hand, and if this opera-

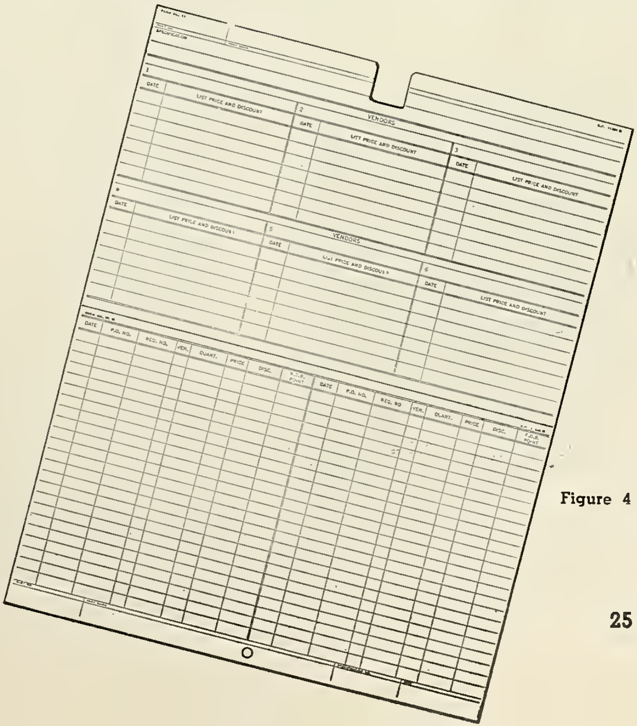


Figure 4

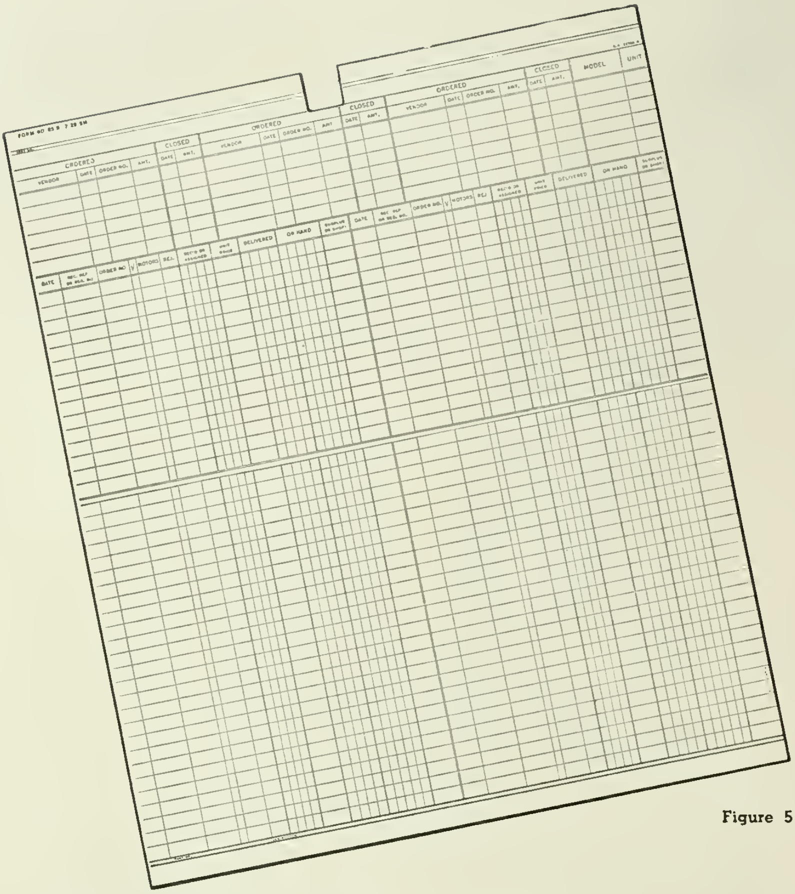

ORDERED
CLOSED
VENDOR
DATE
ORDER NO.
AMT.
MODEL
UNIT
MOTORS
DELIVERED
ON HAND

Figure 5

tion is repeated it is found that the objective in "turnovers per year" has been accomplished.

Manufacturing

Some companies go into many ramifications of stock control, such as unit cost control, production of stock control, tool activity for stock rooms and many others. Space does not permit further detailed discussion here.

Experience has taught that these companies can readily make general use of a standard stock record form, such as is shown in figure 3. This form, giving space for part number, description, maximum or ordering quantity, minimum or ordering print, cost price, list price and the signal control, is printed on two sides and filled in under such headings as "ordered," "received" and "issued." In the "issued" columns, space is devoted to week's supply. This gives the clue to the proper movement of the progressive signal. A vendor's card, similar to the one in figure 2, may be used in this set-up if desired.

One large manufacturing company finds the purchase record (which is a part of stock control) of such great value, that they will not consider combining the two and figure 4 illustrates a two-card set-up for this particular purpose.

Figure 5 shows a two-card set-up of stock and production control of another large manufacturer. This user expressed the desire for space and got it. The card at the bottom is a fold-over style card and is a continuation of the record in the back of the pocket. However, no signal control is obtained on this card. One column is headed "surplus" or "short" and from this the person in charge must memorize all items, or else finger through each pocket in the entire record, to control his stock activity.

Most companies now recognize the fact that stock control is essential, yet, throughout the aviation industry, one finds many examples of its absence. The equipment that these records go into will be found in figures 6, 7 and 8. Figure 6 is a Kardex cabinet which, generally speaking, is used in the 8 × 5 size. This means a card eight inches wide by five inches high. The picture shows the fifteen-slide unit capable of holding 1185 cards. Figure 7 shows a book unit for smaller uses which holds 100 cards, and figure 8 is a fire-resisting Safe Kardex unit for the protection of records. Few persons realize that they cannot collect insurance just by presenting an insurance policy to an agent. The conditions of a policy require *proof* of stock on hand, and unless they protect these records, they may not collect in case of loss.

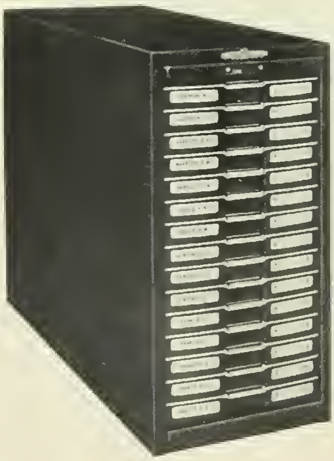


Figure 6

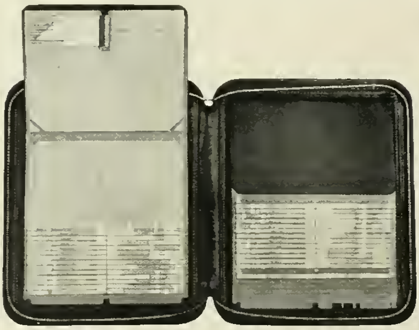


Figure 7

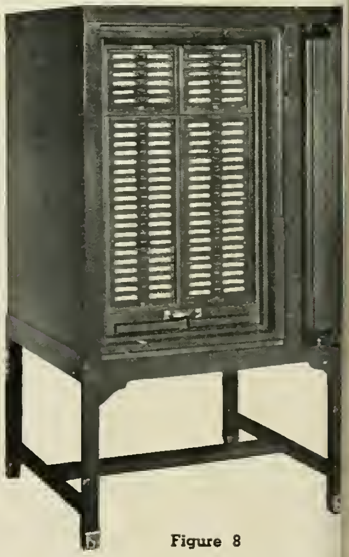


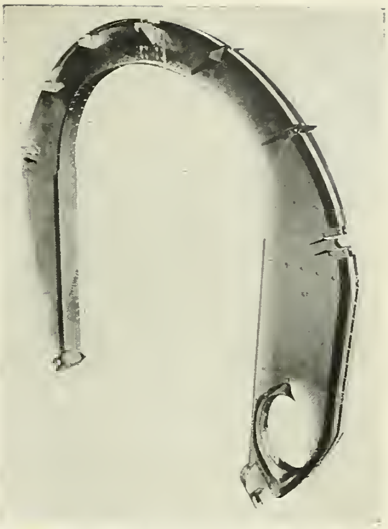
Figure 8

Development of Aluminum for Aircraft

●

C. F. NAGEL, JR.

Aluminum Company of America



24S-RT double bulkhead landing gear support for Douglas transport

● To a peculiar and unusual degree, both aircraft and aluminum are products finding their birth and development in the persistent pursuit of technical knowledge. The impetus and constant pressure responsible for much of the steady development of strong aluminum alloys may be found in the highly technical and exacting demands of the aircraft industry. On the other hand, much of the amazingly rapid development of aircraft was made possible by the constantly improved properties and ever increasing knowledge of aluminum alloy products.

February, 1936, is the fiftieth anniversary of Hall's historic discovery, an event that marks the birth of the modern aluminum industry. Hence, it is appropriate, on this anniversary, to review briefly the story of aluminum in aircraft. The story of one can hardly be told without reference to the history of the other.

Aluminum's Discovery and Early Days

Just as it had been predicted, long in advance of the accomplished fact, that some time man would learn to fly, so it also had been predicted that there existed a metal which was to be known as "aluminum." In fact, this name had been selected by Sir Humphrey Davy years before the element actually had been isolated.

While aluminum is the most abundant metal in the earth's crust, it never occurs in nature in the metallic form but always in combination with other elements. Long before it had been extracted in the metallic state, a number of minerals had been recognized as containing the yet unborn metal. Its base was called alumina and, as early as 1807, Sir Humphrey attempted to isolate from it the metallic element, though without success. The first successful effort is now generally credited to the Danish physicist and chemist, Hans Christian Oersted, who announced to the Royal Danish Academy of Sciences, at Copenhagen, in 1825, that he had obtained the "metal of clay." Others followed, principally Frederick Woehler of Germany and, later, Henri Sainte-Claire Deville of France. The latter scientist's efforts and results aroused the interest of Emperor Napoleon III, who had in mind using this new light metal for helmets and armor and who provided the necessary backing for the erection of a plant for its production. The first introduction of aluminum to the public was some bars made at this plant and exhibited at the Paris Exposition in 1855. Other scientists became interested and began experimentation; but their methods were expensive, and the resulting high cost of the metal held it almost in the category of a laboratory curiosity rather than a commercial material.

Douglas fuselage frame structure fabricated from Alclad 24S-T

On February 23, 1886, Charles Martin Hall, of Oberlin, Ohio, in a wood-shed at the rear of his father's home, first produced aluminum by a process which marks the birth of the modern aluminum industry. In its bare essentials, this process consists of electrically fusing cryolite, dissolving in it aluminum oxide, and electrolyzing from the mixture aluminum in the metallic state. Two years after Hall's discovery, The Pittsburgh Reduction Co., now known as the Aluminum Company of America, was formed for the purpose of producing aluminum by this method. The extraction of the metal by chemical methods soon ceased, and today, Hall's Wood-Shed holds a place in industrial development akin to Lincoln's Log Cabin in political history.

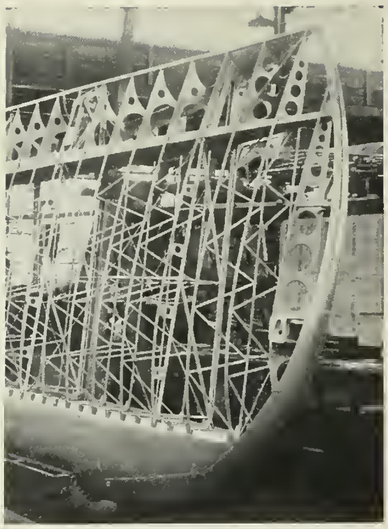
Aluminum's Youth in Aircraft

The earliest application of aluminum in aircraft is not definitely recorded. History mentions that an Austrian, named Schwartz, constructed a rigid airship in 1898 with the framework and outer covering of aluminum. This ship, unfortunately, was destroyed on its first landing. It appears that the first structural use of aluminum in aircraft which proved successful should be credited to Count von

Zeppelin who, after many difficulties, launched his first rigid airship on July 2, 1900. Incidentally, it might be of interest to know that Count von Zeppelin, not unlikely, obtained the inspiration for his later creations from his experience as military observer with the Union Army during the War between the States. He had occasion to note the use of free and captive balloons and made several ascensions himself.

The composition of these early structural aluminum materials varied somewhat. They were principally aluminum-zinc alloys, not heat-treatable but obtained their strength from the alloying elements which were added and from cold working. While these particular alloys lacked certain desirable qualities, for example, durability, they were the only materials available from which the framework of these airships could be built.

In 1909, Alfred Wilm, of Germany, brought forth an aluminum alloy, since known to the trade as duralumin, which was infinitely superior to those formerly available. The superior combination of qualities of this alloy, such as high strength, workability and durability, quickly indicated its usefulness as an aircraft material. This alloy is of particular historical interest for two reasons. It marks the first noteworthy instance where the strength of an aluminum alloy was increased materially by a heat-treating operation. Secondly, in later years, the explanation of this behavior, originated by P. D. Merica and his associates (*Heat Treatment of Duralumin*—U. S. Bureau of Standards, Science Paper 347, Nov. 15, 1919), revealed to the world a new metallurgical principle and one which affected profoundly not only later developments in the aluminum industry but also the metallurgical advance of many other metals. For some years to come, it was destined that duralumin would remain the foremost aircraft structural aluminum alloy in production procedure.



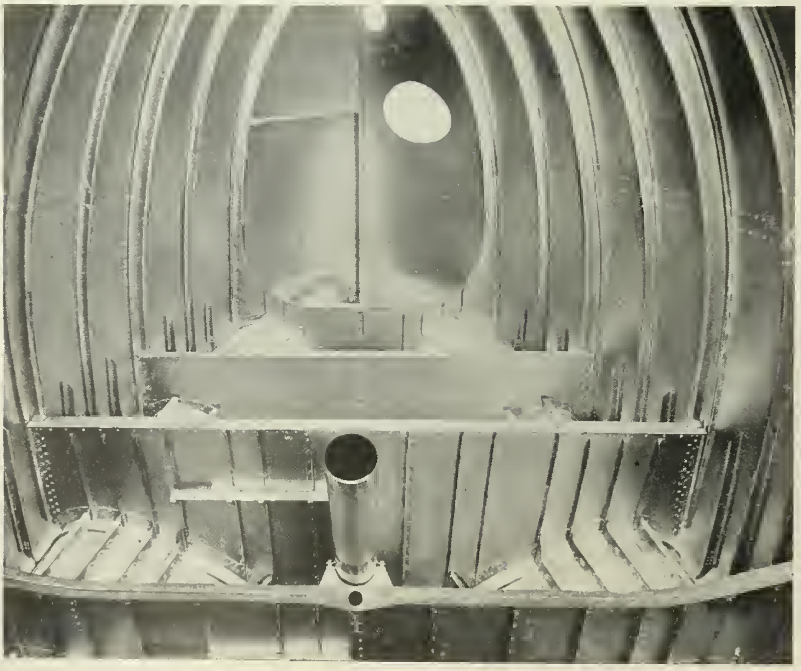
Wing structure of Fairchild cargo plane

Prior to the World War, high tensile steels were costly and not particularly suitable for aircraft structural purposes in the forms then available. The heat-treatable, high-strength, light alloys had just been born. Aerodynamical problems were far more important than the constructional. In the quantities required, wood and fabric were readily available and more flexible than metal, having in mind the few planes built to any one design. For this reason, early planes contained little or no metal. With the advent of war and the recognition of the military value of aircraft, quantity production commenced. This immediately focused attention upon one of the inherent disadvantages of wood, namely, its limited supply. The result was inevitable. The industry decided to study seriously the possibilities of metal construction. The trend toward metal construction may be spotted as having commenced during that period.

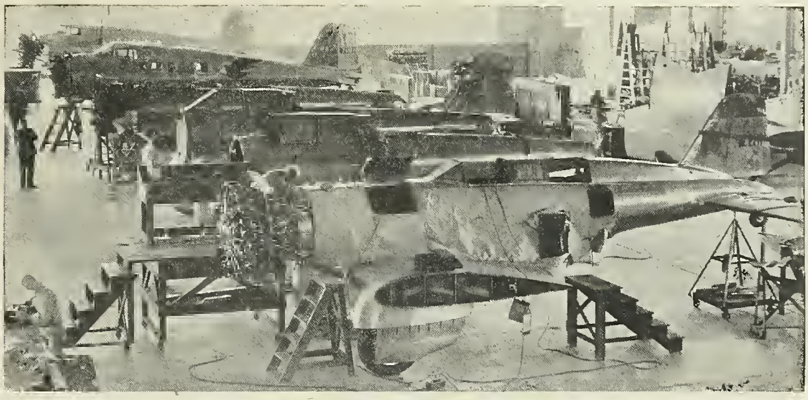
Most of the early efforts involved merely substituting metal for wood, and it is noteworthy that for some years it was not generally possible to determine whether the structure of a particular plane was metal or wood without conducting an internal examination. A few individuals, however, especially Junkers, of Germany, as early as 1910, attacked this problem differently. He foresaw that the only part of the plane's structure which really justified itself aerodynamically was the wing, and that the fullest realization of this conception dictated a wing that was large and thick so as to include within its confines, to the maximum extent, such items as power plant, tank and accessories. This type of construction could be met most satisfactorily by the employment of metal.

With the cessation of war, the production of aircraft almost ceased, due mainly to the relatively large supply on hand. However, nations realized that they must not again risk finding themselves in the predicament in which they were during the war, and active work continued in the development of metal aircraft.

Several conditions conspired to achieve progress of a particularly high order of quality. There are few engineering applications of materials where the demand, with respect to perfection of properties, is so highly exacting as in the field of aeronautics. There is no other engineering structure where the materials must be employed so efficiently and where the factor of safety must, of necessity, be calculated to such a fine point. Furthermore, the nature and status of the aircraft industry, during the years immediately following the war, precluded the entrance, or remaining therein, of any individuals except those possessed of courage, imagination and the insistent will that difficulties could and must be conquered. The industry proceeded with the best materials then available, setting specifications that called for the most constant vigilance for their fulfillment, and ever pressing for continued improvement and advance. The aluminum industry, espe-



Aluminum alloy monocoque bow of Martin flying boat cially in this country, responded, and there ensued during the following years a development marked by a coordination and a sympathetic cooperation between the material supplier and user, to which, in substantial measure, can be credited the remarkable advance made by aircraft and the outstanding leadership attained by American-designed and built engines and planes.



Northrop monocoque fuselage assembly

Aviation's Demands and Results Obtained

This article cannot record the needs and demands of the aircraft industry, nor the results, with any attempt at completeness or much detail. The matter will be limited to mentioning briefly illustrative items pertaining to the plane's structure.

First and foremost is the matter of unit strength of the material. Any particular plane can lift from the ground only a limited weight, including its own. Therefore, every pound by which the weight of the plane may be reduced safely, increases by the same amount the weight of useful load. Maneuverability is likewise affected. The reason for the constant call for materials of construction possessing a higher strength per unit weight is obvious. What does the record show? This may be answered briefly by reference to the guaranteed minimum yield strength applying to these structural aluminum alloys. In 1917, this figure stood at 25,000 pounds per square inch. By successive stages, improvements were effected and new materials were developed, with the result that, today, the aeronautical engineer has available an aluminum alloy sheet with a guaranteed minimum yield strength of 50,000 lbs./sq. in., an increase of 100% in less than twenty years.

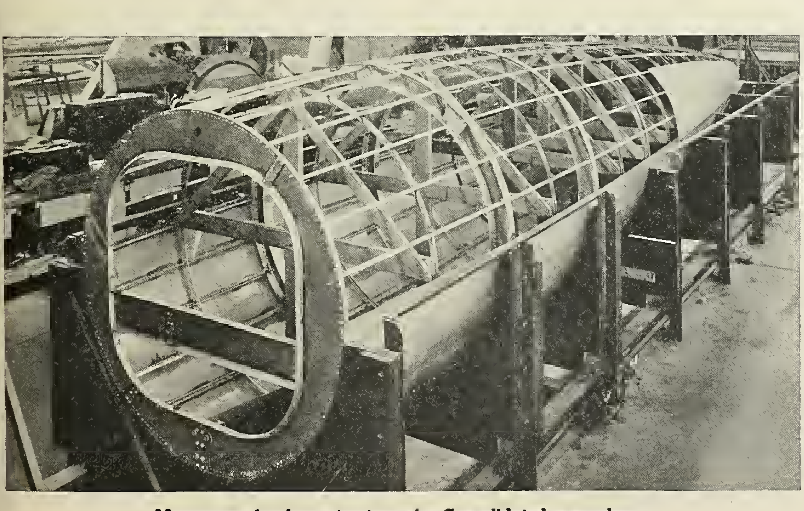
The aircraft manufacturer, almost without interruption, has pressed for sheets wider, longer, thinner and flatter than hitherto available. Greater widths were wanted to reduce the number of joints in the skin covering. An exacting degree of flatness was wanted, especially in the case of skin-covering material, which, because of the thinness and widths of sheets involved, presented a particularly difficult combination of manufacturing problems. Such material was desired in order to reduce air resistance and present a "solid" appearance to the completed plane. What has been accomplished? In the first place, sheet, in the combination of thickness and widths now common (for instance, 0.016 in. by 36 in. by 168 in.), was simply not available a decade ago, regardless of degree of flatness that might have been accepted. Secondly, even a critical examination of the modern all-metal plane is convincing proof that a real job has been done.

Tubes in a greater variety of wall thickness, length and shape were wanted. For instance, streamline sections were required. They have been supplied in an ever increasing range of sizes until, today, streamline tubes are available up to and including those with a major axis of approximately 11 in. and in lengths of about 25 ft. Extruded sections, because of the ability of this type of product to dispose metal most efficiently and because of the reduction in the number of operations required in the aircraft manufacturer's plant by their use, became more and more popular. The aircraft engineer wanted not only more complicated sections but increasing thinness of section. To illustrate progress in this direction, one detail may be selected. In 1920, these strong alloys could not be supplied in extruded form in thicknesses less than ⅛ in. Today, much lighter sections are being produced, thus decreasing the amount of metal, and hence weight, in those portions of a member in which it is not required.

With the many problems requiring solution in early years, it is small wonder that preventing corrosion failed generally to receive the attention it deserved. Major interests lay in other directions. It was not until approximately 1924-1925, by which time a considerable number of planes were built in which varying amounts of aluminum alloys were used. Since many of these planes saw service in the tropics, where exposure conditions are particularly severe, the prevention of corrosion assumed a position of great consequence. It was attacked intensively by many private and governmental groups, throughout the world, with close cooperation with the metal manufacturer, the plane manufacturer, and government and private users.

Representatives of the aluminum industry and the plane manufacturers virtually lived with aircraft in service, learning at first hand the nature and scope of the service problems that existed and instituting the necessary experimentation to solve such difficulties. Thousands of things were done, not alone on technical problems but in distinguishing between and dealing with facts and exaggeration, and in reasonable time, the explanation for such troubles as had been encountered were revealed. Successful methods for overcoming them were de-

(*Continued on page* 84)



Monocoque fuselage structure of a Consolidated monoplane

EDITORIALS

"We do not know what a battle fleet can do against aircraft; or against an enemy fleet superior in air power. Even now there is no sure defense against air attack. None ever has been demonstrated. 'Go out to meet it with planes of your own' epitomizes with fair accuracy the only defense strategy that is worth anything."—LT. GEN. ROBERT LEE BULLARD (Ret.), President, National Security League.

Appropriations and Procurement

● President Roosevelt's budget makes provision for the purchase of 800 Army and Navy aircraft, considerably more than the services received in the last fiscal year.

The enlarged anticipated appropriation indicates that Washington has awakened to the realization that we need a stronger and more modern air force. If the Army could realize that its present methods of procurement work in opposition to our present aerial needs, and would change its methods to make possible quicker deliveries of new and modern aircraft, the country would soon be adequately protected in the skies.

Naval procurement procedure has gone hand in hand with aerial development, giving us a Naval air service second to none. Not until the powers controlling the Army see the light and adopt progressive procurement methods, will we have an air force adequate to sensible preparedness by a peaceful nation.

Air Transport Cooperation

● The air transport industry has seen the value of cooperation. The operators have discovered that in united effort there is greater possibility for expansion along all fronts.

One of the first cooperative efforts was air script, tried some years before but found wanting on several scores. With the new Air Transport Operators Association now functioning this plan should work out to greater advantage. Then there followed the unification of air express, a decided forward step which materially aids the shipper, attracts more business to the airlines and brings the goal of 5 million pounds-a-year nearer to realization.

These projects, however, fade into obscurity compared with the cooperative plan for airliner development in which the major operators will standardize transport equipment and pro-rate among themselves the cost of developing the super-airliner of the near future. While at first this might seem to be a somewhat monopolistic attempt to acquire, more economically, equipment that will overshadow that seen on the airways today, in the long run the entire industry, transport and manufacturing, should benefit.

Now that cooperative effort is more firmly entrenched on sound and logical bases, air transportation in the United States can be expected this year to experience an accelerated growth, and reflect credit on the pioneers with courage enough to depart from old and slow-moving methods of planning.

State Control of Aviation

● The general theory that aviation can only be properly administered and developed by a permanent state body is not entirely in harmony with the thoughts of a great many people in a position to see both sides of the story.

Too often legislation is excessive and has a retarding effect, being too closely associated with unnecessary taxation and additional control which reacts unfavorably on the flying fraternity. Too often these laws call for the establishment of controlling agencies, inducted into which are people, who while they know little about aviation, know considerably more about politics.

If state control of aviation is necessary, there is a way of accomplishing it without going into politics or adding to the already burdensome tax the pilot and airport operator is paying. Let there be permanent commissions composed of non-salaried members from representative districts of their state. Divest them of power to regulate, but empower them to assist aviation development in their states and to advise the legislators on aeronautical matters.

Strenuous efforts must be made to oppose the imposition of taxes on aviation to support a commission. The industry is small and should not be made to carry too many taxes. Enforcement of flying regulations could be made a part of the State Police duties, or local deputies or peace officers, inasmuch as there is such a limited number of Air Commerce inspectors.

When specific laws are necessary they should be enacted and should be capable of enforcement through the courts by existing enforcement agencies.

Organization founded in this manner could be built up without possible selfish objectives or personal gain and is less likely to develop into a racket than many of the present set-ups.

Marine Air Terminals

● The exorbitant cost of acreage near the centers of busy cities has often precluded the possibility of airport development where it would offer a decided advantage in time over present airline terminals. While the time lost in getting from the airport to the city is a negligible factor when the passenger has made a flight of any considerable distance, it is on flights of a few hundred miles that the lost time often equals or exceeds the time saved by air travel.

Development of high-speed amphibions with accommodations for a large number of passengers has again focused attention on marine air terminals as the solution to the problem. Compared with a landplane operation between two waterfront cities say, 200 miles apart, flying time would be about the same, but the time lost in transit from the airport to the city would be eliminated by a landing almost in the heart of the cities.

As long as the WPA is spending money, it would be most appropriate to divert some of it to the development and construction of marine air terminals. These are not only worthwhile, useful works projects, which all WPA projects are not, but they also could be the beginning of an accelerated and expanded activity in seaplane and amphibion operations.

Water flying has many inherent advantages, of which one of the most important is its potential convenience. Almost all of the large cities in the United States are located on water and subject to the so-called "door-step" water landing.

In many instances the relatively small sums needed to accomplish seaplane projects will do more to encourage flying than would the same amount of money if lumped into a corresponding airport program. This advantage applied both to large cities where complete and elaborate marine equipment would be justified, and even more forcibly to the small waterfront towns, which in all probability could not afford any other kind of airport, and yet, by the provision of simple landing floats, could place themselves on the airway map and enjoy the benefits of expanded business and social contacts made possible through our ever-growing air communications.

9 ½ HOURS
LOS ANGELES to NEW YORK
NR 13

HOWARD HUGHES
and the
WRIGHT CYCLONE
Establish a New
TRANSCONTINENTAL RECORD

All transcontinental speed records were shattered on January 14, 1936, when Howard Hughes completed a non-stop flight from Los Angeles to New York in a stock model Northrop Gamma monoplane powered by a new Wright Cyclone—in the phenomenal time of 9 hours, 25 minutes and 10 seconds. His average speed was 263.5 miles per hour.

The Wright Cyclone Engine installed in his plane is the latest production type being built to U. S. Army specifications. It develops 930 horsepower for take-off at sea level, and has the highest horsepower rating, both at sea level and at high altitudes, of any single-row, radial air-cooled engine in the world — due to an exclusive Wright supercharger control development.

The great efficiency of the Northrop Gamma-Wright Cyclone combination is illustrated by the fact that Hughes started from Los Angeles with a fuel load of 690 gallons of gasoline and had approximately 225 gallons remaining in his tanks upon arrival at New York.

Low fuel consumption, characteristic of the new Wright Cyclone Engine, at high horsepower, was demonstrated on this flight by the fact that the 465 gallons of gasoline consumed included the warm-up, full load take-off, climb to high altitude and maneuvering after crossing the finish line—as well as the actual transcontinental flight.

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

Air Commissions and Air Laws

●

MANNY SOMERS

● With the new year comes the beginning of sessions, annual, biennial or quadrennial, of the various state legislatures; and probably more air legislation. Many states will consider the adoption of the new and revised *Uniform State Aeronautic Regulatory Act* endorsed by the National Association of State Aviation Officials and approved and recommended by the American Bar Association Committee on Aeronautic Law, by the Bureau of Air Commerce, by the Federal Aviation Commission and by the National Conference of Commissioners on Uniform State Laws.

Within the past year Illinois, Maryland, Minnesota, South Carolina, South Dakota and Tennessee have adopted the new act in whole or in part; and Massachusetts amended its act to require that pilot and aircraft license conditions meet those of the Federal government or other proper licensing authority.

Twelve states, however, still require pilot and aircraft license or registration fees or both; four states require license fees for airports and landing fields; and three for schools.

Three states require transfer fees for change of aircraft ownership, one state charges a mechanic $1 before he can do any work; two states set a physical examination fee, while one other state requires license fees of $1 each according to whether the licensee is a parachute rigger or a parachute jumper.

Uniformity of fees is not an outstanding feature of any tabulation. Pilots of gliders or power airplanes, balloons or airships pay anywhere from $1 in Maine to $25 in Maryland.

Fees for planes and gliders range from $3 in Alabama to $100 in Idaho, this being the maximum at the rate of 2½ cents a pound of weight of useful load. Connecticut is satisfied with a maximum of $40 at ½ cent a pound of useful load. Michigan is a bit contrary about weight, having set another ½ cent a pound but on the weight empty, with neither a minimum nor a maximum.

For New Hampshire, the airman operating an airport for profit pays $10. If operating from inland waters there is a fee of $10. If the water freezes the fee is but $3 for each area used and the operator is, undoubtedly, entitled to a refund. If the ice melts between hops, then the state would doubtless bring on the law for the other seven dollars. Then there is the question of non-residents who pay an added sum if operating for profit in a state or two.

Of course, we might remember that we are not exactly a nation, one and indivisible, but a collection of 48 separate entities with almost as many varying opinions on aircraft legislation as on liquor taxes. However, the majority of the states have already figured that aeronautics deserves promotion and development, not taxation, and it may be entirely possible that, by some streak of nationalistic spirit, these fifteen states which require an aviation tax of one form or another will eventually climb on the bandwagon. The accompanying table pictures shades of legislative taxing thought across the country.

The Cocktail Hour

Having already suggested the similarity of air and liquor vagaries, what about the "flying cocktail"? Can a passenger partake of a cocktail without being "under the influence" which would make a Connecticut or a New York pilot a violator of the law. One might ponder the possibility of pilots like Eddie Musick or Walter Shaffer or Art Burns or somebody languishing in jail because a nutmeg salesman carried a pint on his hip.

Thirty-three states and the District of Columbia have assigned the regulation of airplanes and the development of aeronautics and facilities to definite state departments or branches of their governments. Who is (or are) going to enforce these licenses and laws?

Aeronautics Commissions

Seventeen of the states have set up aviation or aeronautic commissions or boards, with or without directors of aviation or aeronautics, with budgets running up to $30,000 a year. Within the past year Nebraska, South Carolina, South Dakota and Tennessee have given over the job of regulation and development to specialists.

Thirteen of the states have entrusted aeronautics to the police while in six states the Department of Public Works or Registry of Motor Vehicles or other agencies, operate with an aviator on the payroll to handle airports or the registration of air vehicles.

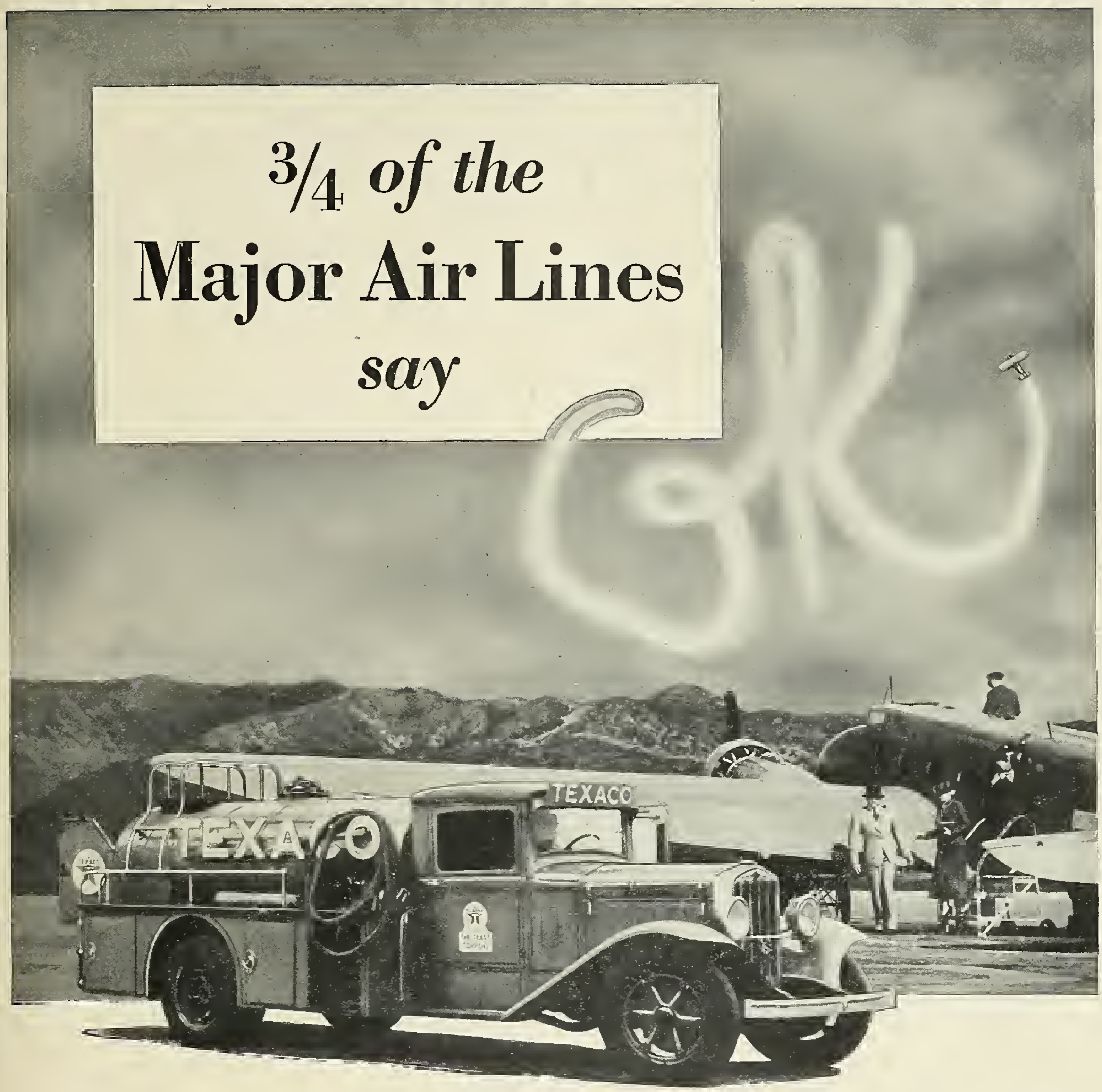
Though Arkansas and Colorado abolished their commissions on aeronautics, the trend is toward permanent bodies specifically charged with regulation and

(*Continued on page* 84)

License Fees By States

	Plane Pilot	Glider Pilot	Plane	Glider	Airport and Landing Field	School
Alabama	$2.00	$2.00	$3.00	$3.00	....	......
Connecticut[4]	2.00[1]	2.00[1,2]	½¢ lb.[3]	½¢ lb.[3]	....	......
Idaho	....	....	2½¢ lb.[5]	2½¢ lb.[5]	....	......
Illinois	....	....	....	....	$2.00 ea.	$2.00
Kentucky	5.00	5.00	5.00	5.00	....	......
Louisiana	....	....	(6)	....	....	......
Maine	1.00[7]	1.00[7]	1.00[8]	1.00[8]	....	......
Maryland	25.00	25.00	52.00[9]	52.00[9]	....	......
Michigan	....	....	½¢ lb.[10]	½¢ lb.[10]	....	......
Minnesota	....	....	25-50[11]	....	$10 ea.	$10.00
Nebraska	....	....	....	....	2.00 ea.	2.00
New Hampshire	3.00[12]	3.00	10.00[13]	5.00[14]	10.00 ea.[15]	......
Virginia	2.00[16]	2.00[16]	....	....	....	......
Oregon	5.00[17]	....	10.00[18]	....	....	......
Vermont	5.00	5.00	5.00[19]	5.00[19]	....	......

1. Cost of Physical examination set at not over $10. 2. Commercial glider license $2, primary 50c, secondary 50c, soaring $1. 3. Plane and glider fee minimum $10, maximum $40, prorated. Manufacturer's permit for test purposes, covering any number of aircraft, $50. Other experimental aircraft $2. Temporary aircraft license for non-resident $2. Aircraft transfer fee $1. 4. Parachute and rigger and parachute jumper must each be licensed at $2. 5. For useful load but not over $100; prorated. 6. Planes carrying passengers for hire must be bonded at $15,000 for first plane and $1000 each additional. 7. Resident pilots—not holding Dept. of Commerce license make flight test for fee of $15. For non-resident pilot, operating for profit, fees $10. 8. For non-resident plane operating for profit, $15. Fee of $25 is charged for inspection if plane is not licensed by Dept. of Commerce. No extra fee for any non-resident glider. Transfer fee $1. 9. $50 plus certificate $2. 10. For empty weight. Also $1 transfer fee. 11. But not over $25 for single-engined nor $50 for multi-engined. 12. Non-resident pays $5 if for gain. No fee for non-resident operating privately if he has Dept. of Commerce license. Mechanic pays $1. 13. Non-resident $15 if for gain. No fee for non-resident plane if flying for pleasure or business. 14. Glider fee $3 whether or not for gain; no mention of non-resident. 15. Airmen operating for hire from water must pay $10 for first water area used and $2 each additional area; operating from ice or inland water the fee is $3 each area used. 16. But fee is $25 for each 30 days if non-resident pilot operates for gain. 17. Physical examination $2.50. 18. Planes holding Dept. of Commerce license not subject to state fee. 19. Non-resident $10 if operating for gain.



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FORM FACTORS FOR STRUCTURAL SHAPES

●

RENATO CONTINI

● The present trend in airplane structures towards all-metal construction, whether of the truss type or of the stressed skin type, has increased the number and variety of sections used to such an extent that existing tables of section properties are no longer sufficient. Individual concerns concentrating on certain shapes for the major amount of their structures have compiled their own tables of section properties, but even then they encounter many cases which need special sections. Quite often a section has been chosen and its properties computed; if the section has been discarded no records of the section properties have been kept for possible use in some other instance where the same section might have served to advantage. This has led to consistent duplication of effort.

In preliminary design a quick, comparatively accurate method for estimating section properties is of great value. The strength of any member, particularly in compression or bending, depends on several of many variables; the shape of the section, thickness of the material, length, radius of gyration, section modulus, etc. With the exception of round members and a few other well-defined shapes, the process of choosing a member involves the cut and try method to obtain a satisfactory section. The present article is intended to present a method for readily obtaining the section properties of some of the more commonly used shapes and to serve as a basis for development to use with a greater variety of sections.

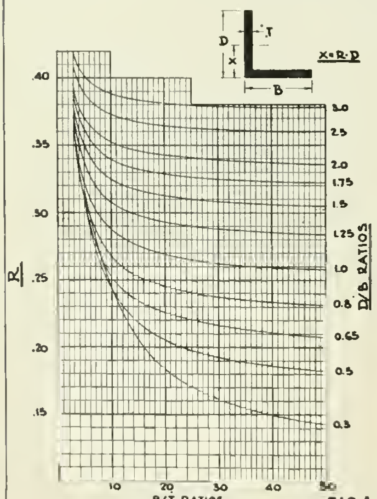
Description and Development of Charts

For geometrically similar sections, the location of the neutral axis, and the radius of gyration, are functions of the depth of the section. That is, either one may be expressed as a constant times the depth. The moment of inertia may then be found from the expression $I = \rho^2 A$ where A is the area of the section, and ρ the radius of gyration.

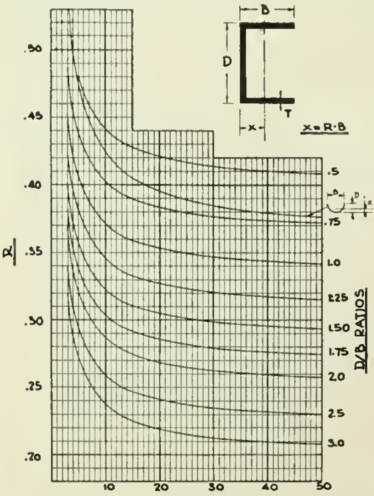
The accompanying charts have been developed on this basis. The constants for a variety of sections have been computed and plotted as later described. In the charts, the constant by which the depth of the section must be multiplied to obtain the neutral axis location, has been called R, and the constant for obtaining the radius of gyration (ρ) has been called K.

In plotting the curves, the sections used have been defined by certain ratios; the ratio of the depth D to the breadth B, and of the breadth to the thickness T. Since the sections illustrated are angles, channels, rounds and rectangles of constant thickness, these ratios are sufficient to define the sections. This practice was followed to conform with such available published data on the strength properties of open and closed sections. The constants R and K may then be plotted against ratios of D/B for different ratios of B/T or as has been done in these charts, against ratios of B/T for different values of D/B. The latter results in a smoother group of curves and therefore has been chosen.

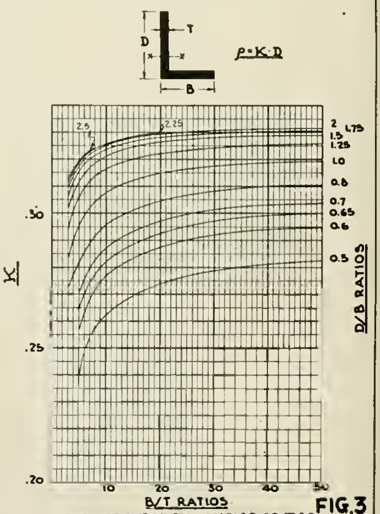
The angle, channel and rectangular sections have been assumed as having square corners. This introduces a certain amount of error in obtaining the properties of sections having rounded corners, such as formed sections, and in sections



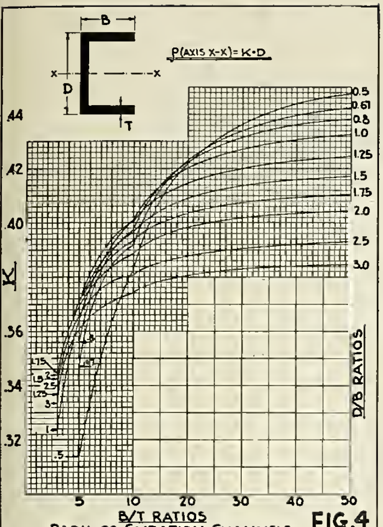
NEUTRAL AXIS LOCATION—ANGLES OR TEES FIG. 1



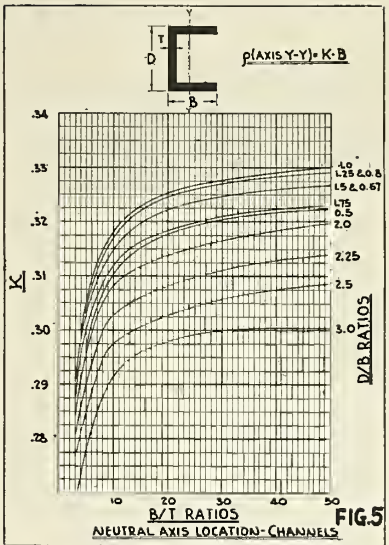
NEUTRAL AXIS LOCATION—CHANNELS FIG. 2



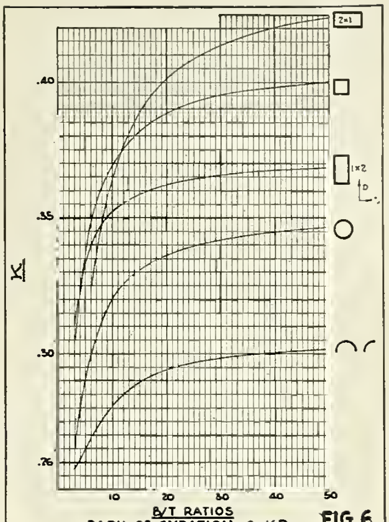
RADII OF GYRATION—ANGLES OR TEES FIG. 3



RADII OF GYRATION-CHANNELS **FIG.4**



NEUTRAL AXIS LOCATION-CHANNELS **FIG.5**



RADII OF GYRATION ρ = K·D **FIG.6**

having filleted corners, such as extrusions. These errors are slight, but are greater for the location of the neutral axis, than for the moment of inertia. The magnitude of error is discussed later and it will be shown that the values obtained are average values, being low for formed sections and high for extrusions.

Figures 1 and 2 give the constant R for locating the neutral axes of angles and channels respectively. In figure 2, a curve for semicircles has been included, in which B represents the outside diameter and $D = \frac{1}{2}B$. Figure 3 gives the constant K for determining the radius of gyration for angles. Figures 4 and 5 give the constant K for determining the radii of gyration about the short and long axes of channels. Figure 6 gives the constant K for various other sections. The constants in figures 1 and 3 may also be used for determining the section properties of Tees, and the constants in figure 4, may be used for determining the radius of gyration about the short axis of Zee sections.

Illustrative Example

Use of these charts may be best illustrated by an example. Given a 2″×1.25″×.125″ channel to determine the neutral axis location and moment of inertia, along an axis parallel to the web. Then according to the notation used $D = 2$, $B = 1.25$ and $T = .125$. $D/B = 2/1.25 = 1.6$ and $B/T = 1.25/.125 = 10$.

In figure 2, interpolating between the curves for $D/B = 1.5$ and $D/B = 1.75$ for values of $B/T = 10$, the value of R is found to be .315. Since the distance X, from the outer face of the channel to the neutral axis is equal to RB, it is equal to $.315 \times 1.25 = .394''$.

The radius of gyration is found in a similar manner by use of figure 5. The value of K for the given ratios is found to be .314, and $\rho = .314 \times 1.25 = .392''$. The area of the channel neglecting any curvature at the corners, is equal to .531 square inches. The moment of inertia along the Y-Y axis for the channel is therefore equal to $(.392)^2 \times .531$ or .081 inches^4.

As a check on the results obtained, and for comparison of the work involved, the required properties are computed in the conventional manner. The neutral axis location is obtained by dividing the moment of area about the outer face of the channel, by the area as $(2 \times 1.25 \times .625 - 1.75 \times 1.125 \times .688)/.531 = .212/.531 = .396$.

The moment if inertia about axis Y-Y is found quickest by finding the moment of inertia about the opposite face and subtracting the area times the square of the distance to the neutral axis, as

$I_{y-y} = I$ base $- Ad^2$

$I_{\text{base}} = (2 \times 1.25^3)/3 - (1.75 \times 1.125^3)/3$, $Ad^2 = .531\ (1.25 - .396)^2$

$I_{y-y} = 1.300 - .831 - .388 = .081$ inches^4.

From the above, it is evident that the number of operations involved are reduced by use of the charts. In fact, two of the operations for use of the charts, the two for obtaining the D/B and B/T ratios would be required for obtaining the strength properties of the section regardless of the method used for obtaining the section properties.

More complex sections may be solved by the use of these charts, by breaking up the section either into angles or channels. The properties of the individual parts are then obtained and combined in the proper manner to obtain the properties of the complete section.

Accuracy of Results

A comparison of the properties of various sections as obtained by use of these charts, with exact values of these properties and the magnitude and direction of the error is given in Table I. The values for the extruded sections used are obtained from structural handbooks. The values for the formed sections have been computed by exact methods.

The greatest error occurs in the values for the extruded channel sections and is due to the irregular thickness of the channel flanges. The other values, especially for the moments of inertia are within the limits of accuracy for preliminary design.

The nomographic chart (figure 7) is one for determining moment of inertia, if the section depth, area and constant K are known. From A the known value of

TABLE I

Sections	Neutral Axis Location Calculated	 From Charts	 % Error	Moment of Inertia Calculated	 From Charts	 % Error
(Extruded Sections)						
1.5 × 1.5 × .125 angle	.41	.426	+4.0	.074	.076	+2.5
3.0 × 1.498 × .258 Channel	.44	.470	+6.5	.25	.266	+6.0
(Formed Sections)						
12 × 12 × angle						
Corner radius 2.5t	3.52t	3.37t	—4.0	306t^4	304t^4	—1.0
16t × 10t × t channel						
Corner radius = 2.5t	3.22t	3.16t	—1.8	313	313.0t^4	0.0

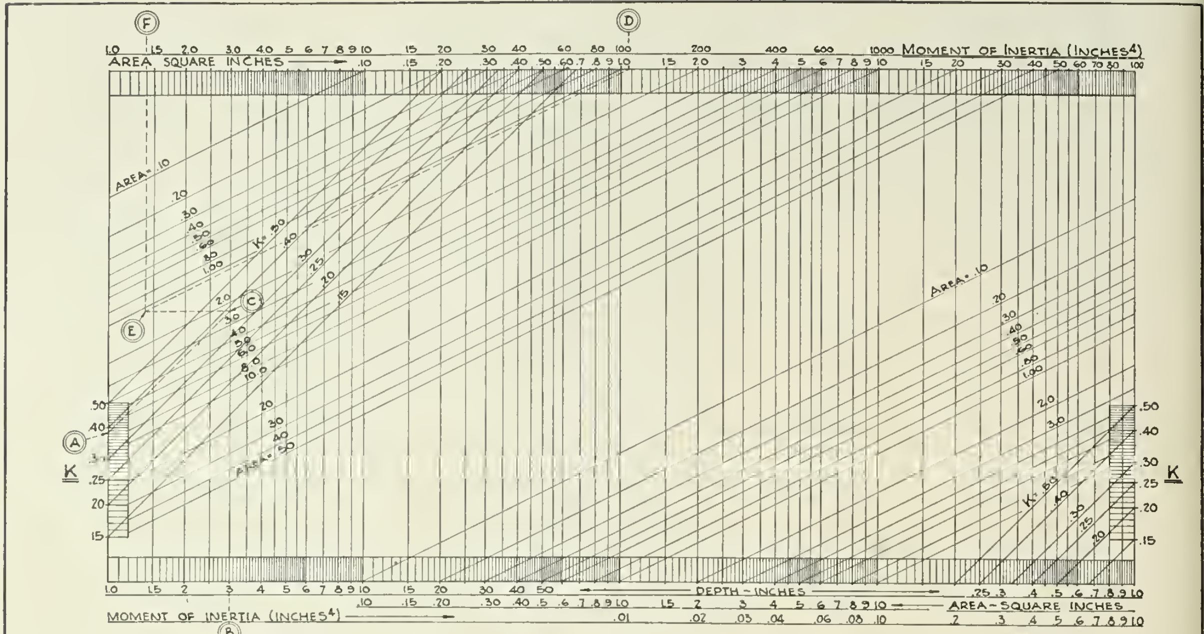


FIG. 7

K along the vertical scale, proceed along 45° line to *C*, the intersection with the vertical from *B*, known depth. From *C*, proceed horizontally to *E*, the intersection with sloped line from *D*, the known value of the area. From *E*, proceed vertically to *F*, the moment of inertia.

This last chart may also be used if the moment of inertia required and the depth and approximate shape of the section are known. Point *A*, an approximate value of *K* is chosen. From *A* proceed along the 45° line to *S* the intersection with the vertical from *B*, the known depth. From *F*, the required value of the moment of inertia, proceed vertically to *E*, the intersection with a horizontal line from *C*. From *E*, proceed along the sloped line to *B* the required area. Knowing the area and depth, proportions for the section which correspond to the chosen value of *K* may be obtained. After short use several other problems encountered in practice will be easily determinable.

Digest of Technical Articles from Foreign Publications

Wind Tunnel

Large Wind Tunnel at Chalais-Meudon (Les Installations de Mesure de la Grande Soufflerie de Chalais-Meudon, par A. Lapresle, Ingéineur en chef de L'Aeronautique, la Technique Aéronautique, No. 137, 3ᵉ *Trimestre* 1935)

The article describes the large open-type wind tunnel at Chalais-Meudon. This wind tunnel has an elliptic cross section with the jet 16 × 8 meters, the airflow being created by 6 ten-bladed propeller-fans of 8.7 meters diameter. Maximum speed obtainable with 4000 h.p. is 180 k.p.h., and the normal speed contemplated for tests is 100 to 120 k.p.h. The equipment available consists of a six component balance, an apparatus for flow exploration in the test portion of the tunnel, a multiple manometer installation for simultaneous determination of local pressures at 40 different points of model, and a propeller testing stand. A detailed description and diagrammatic sketches as well as some details of the balance give a workable picture of the unit. The article contains also the equations for transformation of observed moments and forces into the desired basic parameters.

Magnesium

Magnesium in Aircraft Constructions (Le magnésium dans les constructions aéronautiques, par R. de Fleury, Publications Scientifiques et Techniques du Ministere de l'Air).

This paper presents the metallurgy and technology of magnesium and its alloys, including information on definite application of magnesium in aircraft.

Autogiro

New Developments of the Autogiro by Señor Juan de la Cierva, F.R.Ae. S., The Journal of The Royal Aeronautical Society, No. 300, *December* 1935.

Señor Cierva reviews in his paper different phases of autogiro development covering aerodynamical progress, dynamical problems, the engineering technique, fundamental developments, direct control, suppression of rudder, direct take-off, industrial development, progress of the application and a forecast of the future progress. Considerable amount of progress is indicated by the author in rotor design traceable to the use of better airfoil sections and smaller solidities of rotors. Better performance of the present-day autogiro is due to the direct control principle making unnecessary the use of small fixed wings and going as far as to suppress the rudder. Mechanical improvements in hub, hinge and starter design are notable. Better theoretical and experimental basis are available for blade design.

In addition to the direct control type autogiro the most interesting recent development is direct take-off or the jumping take-off principle enabling an autogiro to leave the ground without any run. Señor Cierva announced this feature to have been actually tried in practice and not merely as a laboratory problem. In forecasting the future Señor Cierva stresses the point of better performance and particularly expects that autogiro will show high speed and load carrying ability of the order obtainable with the best airplanes, without, however, sacrificing autogiro's landing and take-off features. Forming part of this presentation, is an account of the discussion.

(*Continued on following page*)

WACO *Announces a Complete Line of 4-5 Place Cabin Planes*

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● The 1936 Waco cabin planes set a new standard in advanced airplane design and engineering. Refinements that improve the beauty and performance of these ships and add to the comfort of pilot and passengers make these the finest planes Waco has ever built.

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THE WACO AIRCRAFT COMPANY, TROY, OHIO, U. S. A.

WACO AIRPLANES
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(*Continued from preceding page*)

Servo-Rudder Flutter

Experiments on Servo-Rudder Flutter, W. J. Duncan, D. L. Ellis and A. G. Gadd. (British) Aeronautical Research Committee—Reports and Memoranda No. 1652, *September* 11, 1934 *(published October* 22, 1935), 30 *pp.,* 9 *figs. on supplementary sheets,* 16 *tables.*

The experiments described were undertaken to find methods for preventing the flutter of servo-controlled rudders, and were carried out on a model provided with a flexible fuselage, a large number of factors affecting flutter being varied, especially the elastic stiffness and the inertial coefficients of the system. It was found that in the majority of cases flutter could be prevented by suitable mass loading of the main rudder and servo-flap, but there were certain unfavorable combinations of elastic stiffnesses for which flutter prevention was difficult.

High Speed

High speed in Aviation—V Volta Meeting, Rome, Italy (Il V Convegno Volta, Riassunti delle Communicazioni, redatti dal Prof. Pistolesi, L'Aeronautica, Volume XV-N9-10, Settembre-Ottobre, 1935, *Anno XIII).*

The Fifth Volta meeting was held from September 30 to October 6 at the Royal Italian Academy in Rome. After giving the opening speech delivered by the chairman of the meeting, General G. Arturo Crocco, Prof. Pistolesi gives the main outlines of the papers presented. The subject was treated in nineteen papers whose titles are given below.

H. E. Wimperis: Technical Preparations for 1931 Schneider Cup Races.
M. Castoldi: High Speed Italian Aircraft.
C. F. Bona: Italian Motors for High Speed Aircraft.
G. H. Stainforth: British Methods of High Speed Flving and Training of Pilots.
M. Bernasconi: Italian Methods of High Speed Flying and Training of Pilots.
L. Prandtl: General Considerations on Compressible Liquid Current.
G. I. Taylor: Problems in High Speed Flows.
Th. de Karman: The Problem of Resistance in Compressible Fluids.
E. Pistolesi: Lift at High Speeds Less than the Speed of Sound.
A. Busemann: Aerodynamic Sustantions at Speeds Above that of Sound.
M. Panetti: Experimental Problems at High Speeds.
E. N. Jacobs: American Methods of High Speed Aerodynamic Research.
G. P. Douglas: Experiments with Model Propellers.
J. Ackeret: High Speed Wind Tunnels.
H. R. Ricardo: High Altitude Motors—Thermodynamics and Carburation.
A. Anastasi: High Altitude Motors—Mechanics and Cooling.
G. Costanzi: Stratospherical Aviation.
M. Roy: Jet propulsion Using External Air.
N. A. Rimis: Jet Propulsion without the use of External Air.

Turbulence

Further Experiments on Statistical Measurements of Turbulence. —By H. C. H. Townend, D.Sc., of The Aerodynamics Department, N.P.L. Reports and Memoranda No. 1655

In some recent measurements of turbulence cinematograph records of the movements of small masses of heated air have been used to obtain the velocities. Analysis of the films involved determination of the displacement of large numbers of such masses from their mean position. The possibility of inaccuracy introduced by personal factor in reading such films has been tested in the present pipe experiments by using a photo-electric cell to detect the position of the masses instead of measuring them from photographs. The analysis was thereby made automatic.

Results show accord with those obtained by film analysis, and indicate that the method is reliable for making measurements of this kind.

Engine Connecting Rods

The Articulated Connecting Rod, W. J. Evans and E. M. Butcher. Aircraft Engineering, Vol. 7, No. 80, *October,* 1935, *pp.* 254-256, 1 *fig.*

Practical methods of dealing with the mechanics of articulated connecting rods in airplane engines are discussed. The formulas given were derived in the course of investigations of strength, balance and torsional vibration in articulated systems and are believed to be the most convenient and accurate yet available. For calculating the torsional vibration, the torque curve is resolved into its harmonic components. The method given is based on an analysis of the piston displacements and permits the calculation of the inertia torque harmonics due to the reciprocating masses with any degree of accuracy.

Flaps

New Italian Contribution to the Problem of Lift Increasing Devices (Nouvo Contributo Italiano al Problema dela Ipersostentazione, Armando Silvestri, L'Ala d'Italia, Dicembre 1935*—XIV)*

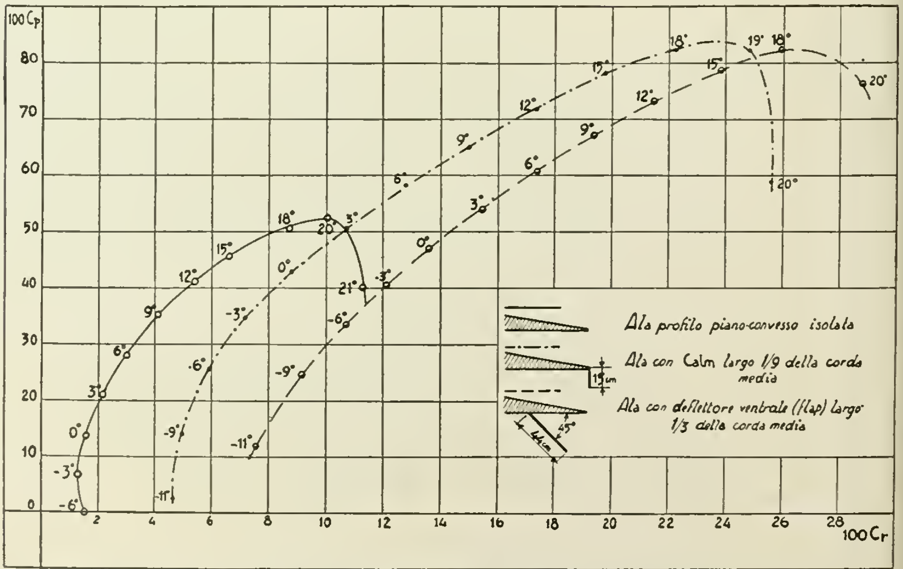
The article describes a new type of a trailing edge flap "Calm" which is the result of combined efforts of Messrs. Caproni, Longo and Mattioli. Data presented gives complete information on the effect of variation of the chord of this flap as well as on the relative position from the trailing edge of the airfoil. Comparative data on ordinary airfoils and airfoils equipped with split flaps is reproduced to show advantages of the new flap. To explain its action, the article gives diagrams of pressure distribution. In addition to an exhaustive wind tunnel investigation the flap is being tested on a small Caproni biplane. According to the author full flight tests are in close agreement with wind tunnel experiments. The installation of the flap is not exactly the same as used in the wind tunnel test, the discrepancy being unfavorable to the full size installation. The author stresses particularly the improvements obtained in lift without, however, appreciable effect on stability despite the fact that the plane in question is a biplane and the flaps are mounted on the upper wing only.

Spinning

Spinning Experiments on a Model of the Bristol Fighter Aeroplane, including the Effect of Wing Tip Slots and Interceptors. By H. B. Irving, B.Sc., A. S. Batson, B.Sc. and J. H. Warsap, of the Aerodynamics Department, N.P.L. Reports and Memoranda No. 1654

This report describes the first experiments made at the National Physical Laboratory, with the new spinning balance in which actual motion of a steady spin can be represented; and moments about two axes measured, one axis being the axis of rotation, and the other an axis fixed in the body of the model, which may by choice be either the yawing axis or the pitching axis.

The Bristol Fighter airplane was chosen for the experiments because of the extensive data on its aerodynamic qualities available, including quantitative data from full scale spinning tests.



Polars for an ordinary wing; the same wing with split flaps, and with "Calm" flaps

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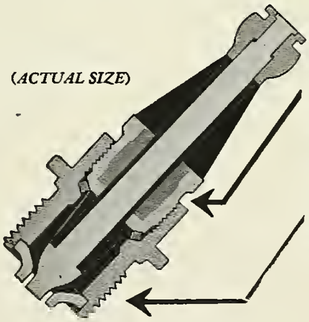

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● Two new de luxe equipped Wright Whirlwinds, claimed by the manufacturer to be the first aircraft engines in their power classes to provide the private owner and operator of small and intermediate commercial transports with the equipment necessary to take advantage of the advances which have been made in radio and navigational instruments, have been announced by the Wright Aeronautical Corp.

The new engines are the seven-cylinder Whirlwind 320 rated 320 h.p. at 2150 r.p.m. and the Whirlwind 450 rated 450 h.p. for take-off and 420 h.p. at 1400 ft. Both models have been approved by the Department of Commerce. ATC 155 covers the Whirlwind 320 while ATC 125 has been issued for the Whirlwind 450.

It is pointed out by the manufacturer that these engines enable the operator of aircraft whose power requirements they meet to enjoy the benefits of developments which have sprung from air transport experience. In addition to being provided with special drives for the operation of generators, a vacuum pump for the actuation of navigation instruments, mechanism for hydro-controllable propeller, and complete radio shielding, the new Whirlwinds feature full pressure baffling, automatic valve gear lubrication and an alternate mounting diameter.

The Whirlwind 320 is the latest variation of the seven-cylinder Whirlwind which previously had been approved for outputs of 235, 250 and 285 h.p. Except for its special equipment and minor refinements of design, it is basically the same as the seven-cylinder 285 h.p. Whirlwind. It has a compression ratio of 6.3:1 and a blower gear ratio of 9.17:1 as against a compression ratio of 6:1 and a blower gear ratio of 7.05:1 for the Whirlwind 285. Fuel of 80 octane number is required. This engine has a low weight/horsepower ratio for at the standard dry weight of 515 lbs. it shows 1.6 lbs./h.p.

The Whirlwind 450 is a further development of the Whirlwind 420. Like the Whirlwind 320, the 420 operates on 80 octane number fuel and has compression and blower gear ratios of 6.3:1 and 10.15:1, respectively. Its dry weight is 615 lbs.

Torsional vibration has been eliminated in the new engines by the incorporation of the Wright dynamic damper in the crankshaft assembly. Adapted from the Wright Cyclone, this device enhances smoothness of operation by counteracting torsional vibration at all crankshaft speeds, removes critical periods and eliminates all restrictions in the normal operating range. The Whirlwind 320 is supplied with the 20-spline crankshaft which permits the use of a lighter and more efficient hub in installations where hydro-controllable propellers are utilized.

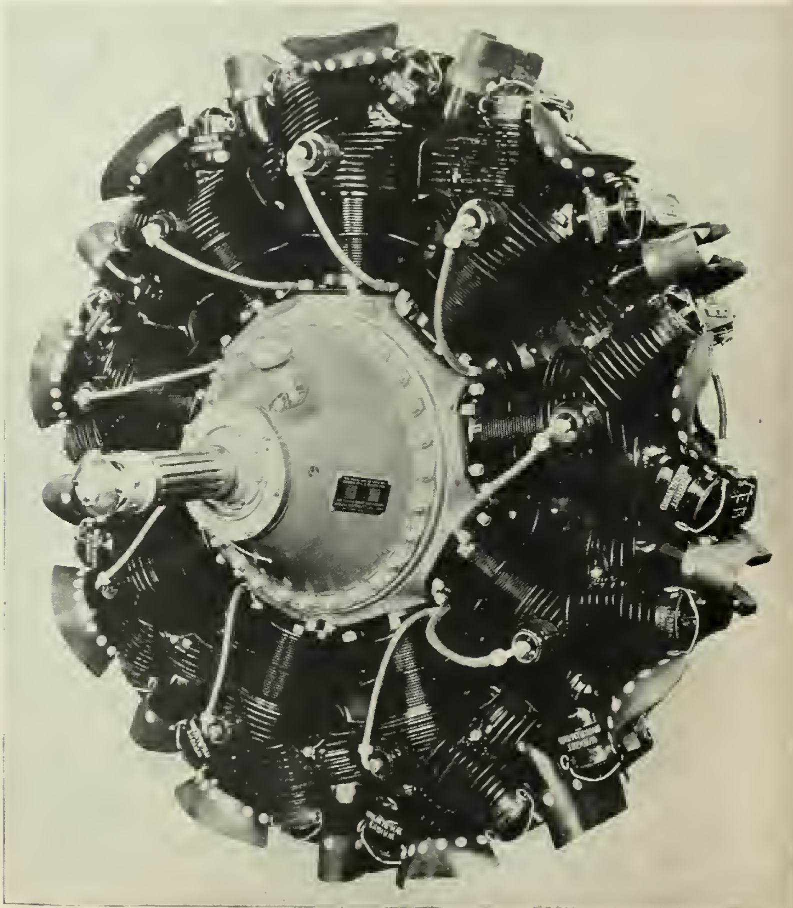
Both the Whirlwind 320 and the Whirlwind 450 are fully equipped for the installation of radio receiving and sending sets. Complete radio shielding is provided including shields not only for ignition wiring but magnetos as well. Radio-shielded spark plugs also are furnished. To provide for the operation of a standard type of aircraft engine generator to charge storage batteries for the operation of radio, lights for night flying or flaps, a special drive is incorporated in the rear section. These engines also are provided with a special drive for the operation of a vacuum pump for operating the Sperry gyro horizon, gyro compass or gyropilot.

Inter-cylinder and cylinder head air deflectors of Wright design furnish full pressure baffling on the de luxe Whirlwinds. Blast tubes located in the inter-cylinder baffles between the cylinders provide adequate flow of cooling air over the accessories mounted at the rear of the engine. Each baffle may be detached individually without removing cowling or other components of the baffling system or engine.

Lubrication of the de luxe equipped Whirlwinds is entirely automatic. All parts of the engine including the valve gear are supplied with oil under pressure from the main lubricating system.

In addition to being automatic, the valve gear lubricating system is of the non-returnable type, since the oil entering the system is not returned to the main supply. An automatic metering pump which readily may be regulated to meet individual operating conditions regulates the flow of oil to coincide in the

(*Continued on page* 84)



Three-quarter front view of the 9-cylinder, 450 h.p. Wright Whirlwind

The
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Boeing has always built tomorrow's airplanes today!

The "Slinger-Ring" De-Icer for Propellers

●

P. T. W. SCOTT

Pilot, Transcontinental & Western Air, Inc.

The latest advancement in the protection of aircraft from ice formation hazards is the development of the slinger ring type of propeller de-icing equipment, which, used in conjunction with a spinner during recent extensive tests, kept the propeller clear of these formations. TWA found the slinger ring so practical that it is equiping its Douglases (already employing Goodrich wing de-icing overshoes) with the device for operations this winter. This commercial use will undoubtedly expand present knowledge of icing, by permitting regular flights to proceed through what has heretofore been considered hazardous conditions, and therefore avoided. The new observations now possible may also indicate that other parts of the aircraft need protection before the most severe conditions can be flown for long periods. The slinger ring apparently solves the problem of de-icing the propeller in a simple and effective manner, and by safeguarding engine power, adds materially to the regularity and safety of operations.

● In the early days of the air mail, pilots had little understanding of the conditions under which ice formed on aircraft in flight, and regarded the phenomena in the light of icing as familiarly known on the ground. The first conclusion was that icing could occur only in a narrow temperature range, and that while this temperature range would be spread a few degrees from the freezing temperature of 32° F. by pressure changes and by evaporation, it was believed that by flying in a region substantially below freezing temperature, ice accumulation could be avoided. This is correct only if moisture is not present in a supercooled state. Data is now available showing that clouds of supercooled droplets may be formed at temperatures as low as those found in the Antarctic regions. Thus seeking colder levels during winter flying is not a solution of the problem and therefore mechanical aids must be relied upon if flight is to proceed uninterrupted through overcast conditions.

A droplet in a supercooled state, when disturbed by striking an object, immediately starts to freeze on it, first changing into a slushy mixture of ice and water at 32° F., and then as the latent heat of fusion is removed through partial evaporation (or through conduction to the structure) the remainder changes to solid ice. Frozen particles like dry snow, cannot adhere by themselves, but they can be fused into the general mass when there is a combination of the aforementioned conditions. At temperatures as high as 34°, moisture collected on the plane may be sufficiently cooled by its partial evaporation to form ice. When the temperature of the plane (due to climbing or descending) differs from the portion of the cloud it is in, ice formation may be accelerated.

For a consideration of ice on the propeller in addition to its formation, it must be of a hard tenacious type, able to resist the forces tending to throw it off. A sticky snow which may build up at an alarming rate on the leading edge of the wing may never collect on the propeller, while a harmlessly thin layer of clear ice on the wing may form simultaneously with a thicker layer of clear ice on the propeller, thus seriously effecting its operation.

In view of the many variables, such as amount of visible moisture, and its state; temperature and relative humidity of the air; the plane's speed, heat conducting ability, and its temperature; we have a better appreciation of the difficulties meteorologists have in predicting the regions in which ice is likely to be accumulated, its type and the rapidity with which it will build up. The gathering of definite data on ice formation in flight has always been a problem because observation is difficult, photography nearly impossible, and the best of the evidence is usually lost by the time the pilot has flown from the hazardous area and landed safely. In laboratory experiments, the problem of accurately duplicating the multiplicity of icing conditions as they actually occur has not been completely solved.

The old type plane, underpowered and overloaded, offered such an expanse of wings, struts and brace wires, for the visible accumulation of ice that the pilots assumed that all their troubles were due to the increased weight, and the resulting drag and loss of lift due to the change of the airfoil section. Not until the modern plane, equipped with the Goodrich de-icer overshoes, was adequately overcoming these phases of the situation, did it become apparent from continued loss of power and vibration that this was not entirely the case, and that de-icing of the propeller was a major problem.

Conditions for the formation of ice on propellers are similar to those of any other airfoil section. The speed of the blade through the air as it revolves is considerably greater than the speed of the plane, which means that more potential icing particles will be contacted by the blades' leading edges. The blade, with respect to the air, is functioning as an airfoil just as the wings, and collects ice in much the same manner.

The effect of centrifugal force is greater near the tips, and this (aided by a certain amount of flexing), throws off much of the ice from the outer portion. Under conditions forming soft rime ice, or frozen slush, on the wings, the propeller may keep itself clean. Clear glaze ice, however, cannot be thrown off as readily and will build up on the inner, slower moving and stiffer portion of the blades. The hub and shank will collect ice most readily, but this is only serious in that it serves as an anchor for ice on the working portion of the blade. The extent to which the outer portions will keep

TWA Douglas Transports are now being provided with slinger ring de-icers themselves clear will depend on the tenacity of the ice, the speed and size of the propeller, and the amount of flexing of the blade. Thus it is possible for a portion of the blade to become iced up in a manner comparable to that of a wing.

Effect of Ice on Propeller

The most serious effect of icing can best be described by quoting the pilot who said, "The propeller iced up until the blades were as useless as swinging clubs." Even a small amount of ice can cause an appreciable reduction in the efficiency of the blade because, under these conditions it not only requires more engine power for the same r.p.m. due to increased rotational drag, but provides less forward thrust due to the ineffectiveness of the ice-altered airfoil section. The plane will feel heavy and unresponsive to the pilot, as speed and possible altitude cannot be maintained with what is now in effect, an underpowered craft.

Although not as evident in single engined craft, ice is thrown off the propellers in pieces large enough to dent the sides of a modern multi-motored plane. The area in line with the propellers has no windows and is not easily damaged, but the noises of flying ice hitting the fuselage are distracting to the occupants.

Another effect, and one that might be a definite hazard, is excessive vibration. While at first only rough engine operation is caused by the aerodynamic changes to the blades, if more ice is thrown from one blade than from its mates, the unbalanced weights induce vibration. Although there is no record of damage to a plane of modern design because of this, the shaking may become so severe that the pilot will feel forced to throttle down, in which event, reduced centrifugal force will permit ice to adhere further out on the propeller blades, again aggravating the prime effect of loss of engine power.

The Remedy

First of all, the spinner is an essential, albeit minor, aid as it is a simple and effective means of keeping ice off the propeller hub and shanks. Its conical shape, when covered with oiled rubber, will remain clear of ice except for a small harmless piece at its apex. In addition, it serves an important part in protecting the adjustable pitch mechanism, and keeping this central area clear, inasmuch as ice at this point serves as an anchor for that forming further out on the blades.

The forerunner of the present method of protecting the blades was a rubber covering cemented on their most susceptible portion. This covering was soaked with oil before the take-off on a flight through possible icing conditions. Pine oil generally was used because rubber would absorb it in a relatively large quantity at moderate temperatures, and it would ooze out during flight. Having a low freezing point, this light oil formed a lubricative surface between any ice that formed, and the rubber, centrifugal force and wind would eliminate the ice formation as soon as it built up to any appreciable amount.

The rubber served chiefly as a carrier, or wick, for the oil. Using up oil was essential to the process and this method was effective just as long as the oil kept oozing out of the rubber to replace that "rubbed off" the surface. Although this development was put into use on mail planes in 1932, it was not entirely satisfactory, for after a short flight its effectiveness was lost, and it was necessary to land in order to apply a fresh oil supply to the rubber.

The slinger ring was a logical step as a mechanical device which could deliver a small continuous supply of fluid to the rubber when needed. This fluid, delivered to a critical point on the shank, is spread the length of the blade fanwise, by the combined effect of centrifugal force and the airstream. Engine oil leaking from the crankcase frequently does the same thing, but never effects ice because it is too viscuous at low temperatures. It was proven by tests that the slinger ring was as effective on bare blades as when used in conjunction with the rubber covers, so the device was simplified to consist of a suitable fluid reservoir, and a method of controlled distribution. It was also shown in tests that if a fluid, such as alcohol is used, this method would remove ice that had already formed, as well as prevent its further formation. Apparently when the fluid spreads out to ice that has formed, it is dissolved into the ice. The low freezing-point fluid formed is thrown off, and working from the center outwards, the under cutting process continues to undermine the ice cap until it breaks up and is thrown clear.

A supply tank of a few gallons capacity is conveniently located in the fuselage, and there is a method of controlling the supply within easy reach of the pilot and co-pilot.

In the experimental installation, a valve and an engine primer pump were found satisfactory, and are still incorporated as a standby. For economical operation, and without additional burden on the crew, a small electrically-driven metering pump is used; one pump controlling the supply to all of the engines. For operation, it is only necessary to snap on an electric switch.

The supply line is a small metal tube, which runs out through the wing and nacelle, and around the nose of the engine to pour the fluid into the annular collector ring. This ring is a circular trough, about a foot in diameter and ⅝" deep by ½" in section fastened to the back of the propeller at the hub. The end of the supply line projects slightly within the

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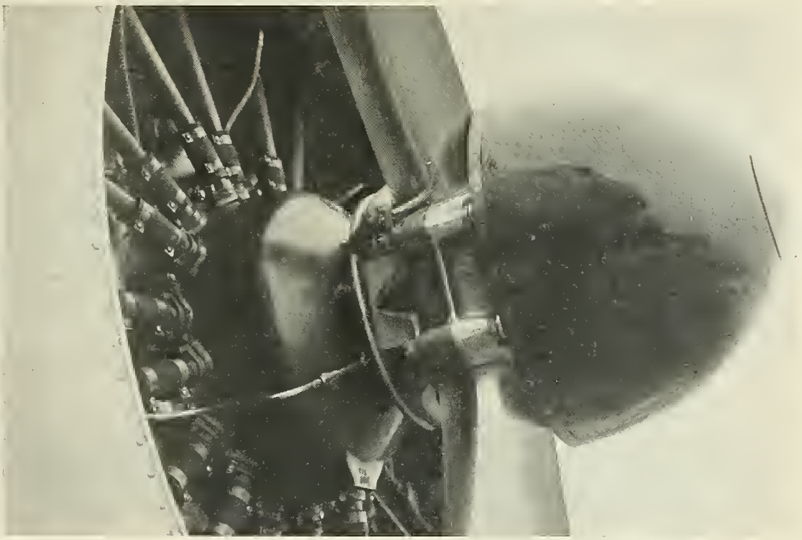
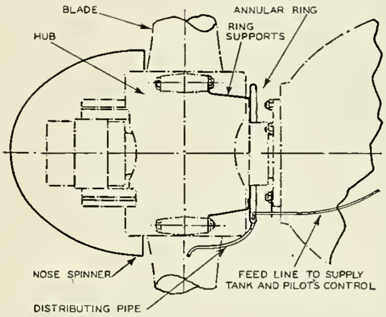


Photo by P. T. W. Scott



Diagrammatic sketch showing arrangement of the propeller de-icer and photograph of its installation

Italy's New Aviation Center

● Fifteen miles from the city of Rome, the Italian government recently opened what is claimed to be the world's most modern and completely-equipped aerodynamic laboratory. Every institution in Italy which has been engaged in any type of aeronautical research is being centered in this vast new scientific plant where studies are to be made to improve both Italian civil and military aviation. Practically every condition encountered by aircraft and aircraft engines will be simulated to enable research in every phase of aviation.

Six buildings, possessing every device and machine for testing engine behavior and fuels under any condition, cover 570,000 square feet of space. One of the special departments in this part of the laboratory is devoted entirely to experimentation of engines under such conditions as exist in the stratosphere.

Experiments in the resistance to motion of seaplane floats through water will be carried on in a hydrodynamic tank, one-third of a mile in length. Six aerodynamic tunnels are used for testing the resistance of models in varied accelerated movements and at different speeds. In one of these tunnels which duplicates the conditions in the stratosphere, it is possible to create a wind of tremendous speed under very low pressure in order to effectively conduct experiments looking to the future utilization of the stratosphere for fast, long distance flights.

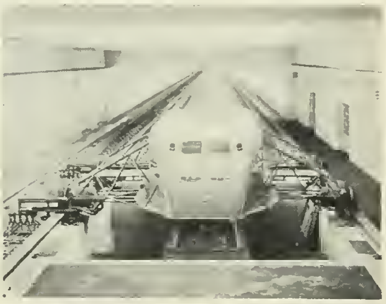
Laboratories are provided for testing all types of radio apparatus; for instruments and accessories as well as of the various materials used in the construction and repair of planes. Defects in materials used in plane construction are investigated in extensive laboratories in the physical and chemical department and X-ray machines are also widely used.

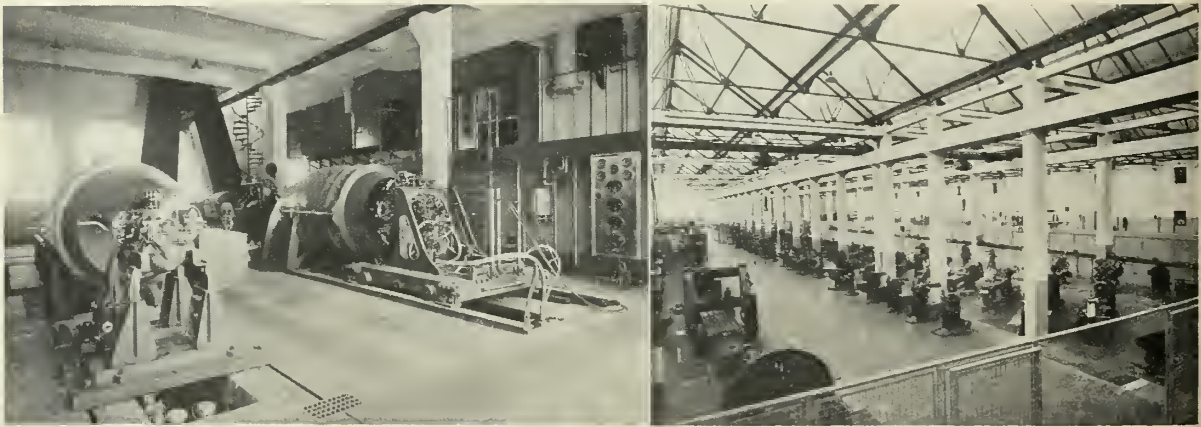
Photographic laboratories are equipped for making aerial maps and pictures, and exhaustive experiments in the improvement and perfection of photographic apparatus will be carried on.

The new aviation center will include, in addition to various laboratories and research offices, a number of experimental shops where new equipment, accessories and complete aircraft will be constructed and tested. An inspection of the machine shops and stock room suggests the fact that an extensive program of construction of equipment and experimental units is contemplated.

Adjoining the new experimental center a new city, to be named Guidonia, is being built by the government to provide modern living conditions of the highest order for the workers employed in the laboratories.

The name of the new city is to commemorate the memory of General Guidoni who tragically lost his life in the course of an experimental parachute jump. General Guidoni was well-known in American aviation, having been attached to the Italian Embassy in Washington as Air Attaché. He has contributed greatly both to practical and theoretical phases of aircraft and particularly notable is his pioneering work on seaplane design and construction.





The hydrodynamic tank, engine testing laboratory, and machine shop in the new Italian aeronautical research institute

Radio for Private Flyers

Western Electric 19A MIDGET TRANSMITTER

Weighs only 10 lbs., 10 ozs.

It's got everything!

Designed for *small* planes: made by Western Electric —test flown and reliable.

Light weight: 10 lbs., 10 ozs. Power supply, microphone, etc., add only 16 pounds.

Small size: 8½″ x 9¼″ x 6½″. Antenna meter built-in.

Three types of transmission: 100% modulated TELEPHONE, CW and MCW—selected by switch.

Remote or local control. Press-to-talk Microphone. 2000 to 7000 KC—crystal controlled.

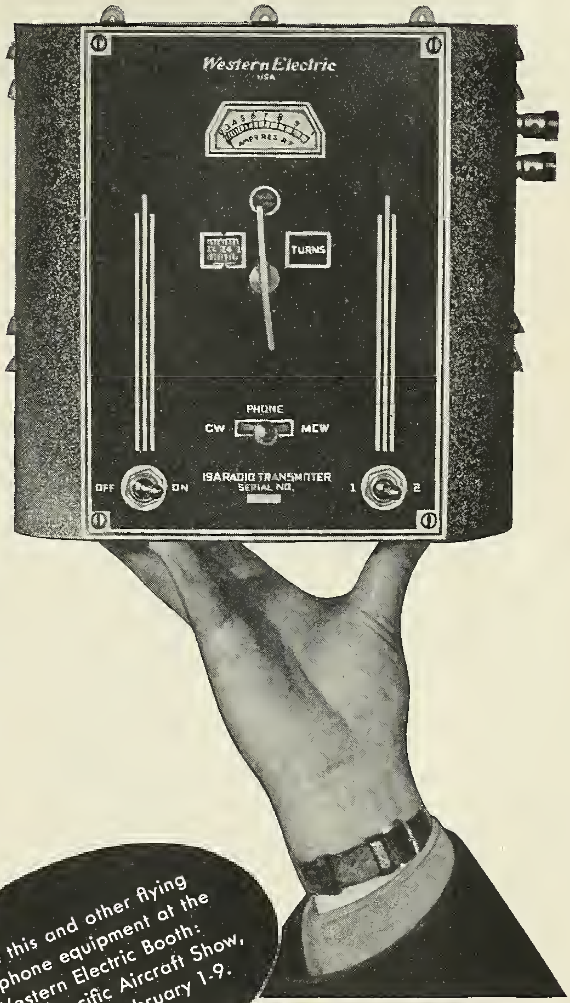
Quick shift from 3105 to 3120 KC thus meeting Federal Communications Commission order.

Simple to install: all electrical connections through one plug. Shockproof mounting.

Uses only two tubes: newest pentode type.

Operates from 12 volt plane battery.

Any type antenna. Built-in relay permits using same antenna for receiving.



See this and other flying telephone equipment at the Western Electric Booth: National Pacific Aircraft Show, Los Angeles, February 1-9.

Don't forget its companion . . . the 17A Midget Receiver for 2-way

Day in and day out, private flyers in all types of planes rely on this equipment. It's built to the same high standards as the larger Western Electric units used in airlines communication service.

When you fly on any mail carrying air transport line, you fly with Western Electric Radio.

For full details: Western Electric Co., Dept. 300 AD, 195 Broadway, New York.

Western Electric *Northern Electric in Canada*

TWO-WAY AVIATION RADIO TELEPHONE AND TELEGRAPH EQUIPMENT

Stinson Model B Bi-Motor

B. D. DEWEESE
President, Stinson Aircraft Corporation

● A low-wing monoplane of the gull wing type, the new Stinson Model "B" Bi-motor follows the design of the Stinson Tri-motored Airliner in appearance and structure, except that it is powered by two 260 h.p. Lycoming R-680-5 engines and accommodates six persons instead of ten as in its larger counterpart.

In announcing the new plane, we established a selling price of $19,950. The cabin has ample room for six, and is efficiently insulated against noise, heat and cold. Space for baggage and lavatory is available in the rear of the cabin, and tankage for 150 gal. of fuel and 10 gal. of oil is provided.

Standard equipment includes three 1½ min. flares; retractable landing lights; complete bonding and shielding for radio; vacuum operated flaps; hydraulic, hand-operated semi-retractable landing gear; controllable pitch propellers; electric starters; 15 amp. generator; and hydraulic brakes. Standard instruments include turn and bank, airspeed and rate of climb indicators, compass, altimeter, tachometers, manifold pressure gauges, oil pressure and temperature indicators.

In designing the Stinson Bi-Motor for private executive use as well as for foreign and domestic feeder lines, better than usual single engine performance was believed necessary and the question of slow landing and rapid take-off assumed major importance. Compromises were made in speed in order to acquire safer landing characteristics and easier handling with one engine. Simplicity of design was a goal and a number of complicated parts which require attention and maintenance were eliminated.

Cruising speed of the plane ranges from 152 m.p.h. at 1,000 ft. to 160 miles at 6,000 ft. with a wing loading of 18.5 lbs./sq.ft. and a power loading of 12.7 lbs./h.p. Take-off run requires 650 ft., the initial rate of climb is 1100 ft./min. and service ceiling is 16,000 ft.

By increasing the wing loading to 20 lbs./sq.ft., speed could be increased, but single engined performance, as well as service ceiling, landing and take-off characteristics, would be impaired unless the plane was uneconomically overpowered.

The single-engined ceiling problem was approached from a new angle. Assuming that a 9,000 ft. mountain range had to be crossed, the plane could be climbed to 10,000 ft. In the event of engine failure at this altitude the fully loaded plane could be flown for 10 minutes (or 19 miles) on one engine before reaching 8,000 ft. An additional 26 miles, or 14 minutes of flying, would be required before the plane descended to the 6,000 ft. level and from this height it could fly on one engine for 50 minutes (85 miles) before reaching approximately 4,000 ft. where it could maintain its single-engined altitude as long as the fuel supply lasted.

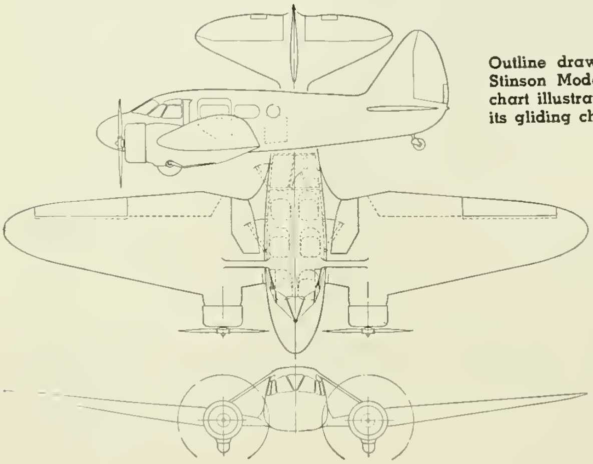
The stress carrying structure of the plane is metal. The propeller zones of the wings are also metal-clad.

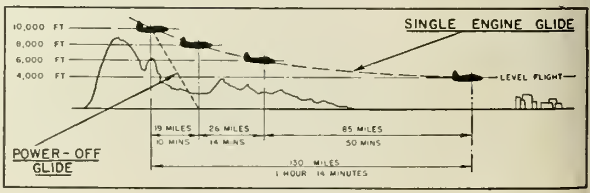
Specifications

Wing span	52 feet 6 inches
Overall height	31 feet 8 inches
Overall length	10 feet 6 inches
Wing area	357 square feet
Wing loading	18.5 lbs./sq. ft.
Power loading	12.7 lbs./h.p.
Empty weight	4500 pounds
Useful load	2100 pounds
Payload	1150 pounds
Gross weight	6600 pounds

Estimated Performances

Cruising speed (6000 ft.)	160 miles per hour
Cruising speed (3000 ft.)	155 miles per hour
Cruising speed (1000 ft.)	152 miles per hour
Rate of climb	1150 feet per minute
Service ceiling	16,000 feet
Service ceiling (1 engine)	3800 feet
Cruising range (full load)	900 miles
Take-off run	650 feet





Outline drawings of the Stinson Model B, and a chart illustrating some of its gliding characteristics

WINNING DESERVED ACCEPTANCE IN A "NEW" AIRPLANE YEAR

So appealing is the new 1936 'Reliant' that all January production records are being shattered. Here the first group of five Stinson Distributors are ready to take-off in a body with their new 'Reliants'.

THE NEW 'RELIANT' FOR 1936 IS READY
SEE IT! FLY IT!

STINSON Distributors for Boston, Providence, New York, New Castle, Del., Washington, D. C. (Alexandria Airport), Chicago, Louisville, Atlanta, Dallas, and Los Angeles have already received their new 1936 'Reliants'.

See and fly in the new 'Reliant'. A flight will do more to convince you of its outstanding merit than all the words that we might write.

This much we will say. In every way the new 'Reliant' is the finest 4 passenger cabin plane we have ever built. The new 'Reliant' retains all the fine qualities of its famous 1935 predecessor, but has the following points of superiority.

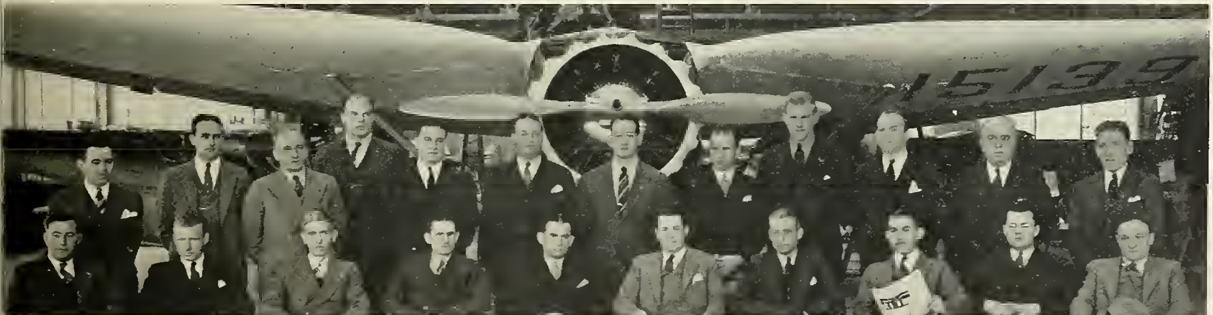
1. **Cruises 15 MPH faster.**
2. **Takes off with less run.**
3. **Climbs faster.**
4. **Has a greater service ceiling.**
5. **Has a greater cruising range.**
6. **Carries more useful load.**
7. **Gives an even easier ride and is easier to fly.**
8. **Greater economy—saves 12% in gas and oil alone.**
9. **Introduces Vacuum Flaps with Slots which enable the 'Reliant' to descend slower than a parachute and to stop with a landing roll of only 250 feet.**
10. **The entire wing structure including spars and ribs is metal.**

WRITE for Your Free Copy of Stinson Plane News.

STINSON AIRCRAFT CORPORATION

WAYNE, MICH., U. S. A.

Division Aviation Manufacturing Corporation



Group of Stinson distributors and factory representatives who attended the annual sales convention at the Stinson factory during January.

The Case of the Aircraft Diesel Engine

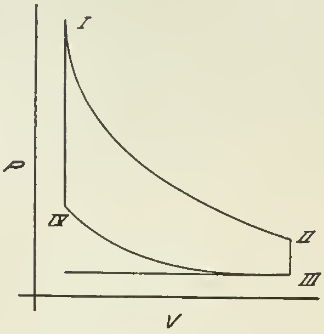
JAMES P. EAMES

● In consideration of the recent advances made in the field of aircraft Diesel-engine research, it is proposed in this article to enumerate and discuss the methods followed, the difficulties surmounted and the results obtained. The only means of procedure in establishing the value of aircraft oil-engine practice is by analysis based upon comparison with existing aircraft power plant practice—the gasoline engine.

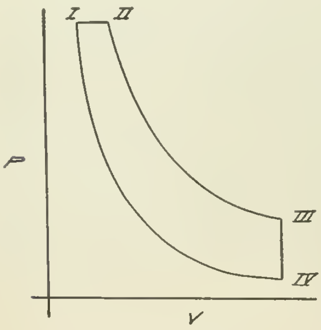
Exponents of the oil burning engine have classified the following as distinct advantages of the oil-engine over the gasoline engine: (a) higher fuel economy; (b) decreased fire hazard; (c) adaptability to the two-stroke cycle; (d) non-interference with radio communication; (e) greater safety due to the ability to carry full load without warming up; (f) cooling problem simplified due to lower heat losses to cooling system; and (g) exhaust disposal simplified due to lower heat losses through exhaust.

The generally accepted disadvantages of this type of engine lie in: (a) increased weight-horsepower ratio; (b) roughness of operation due to the severity of the explosion forces; (c) use of a less clean fuel; (d) higher initial cost per horsepower; (e) lower mechanical efficiency; (f) lower brake mean effective pressures; and (g) inability to supercharge beyond certain practical limits without loss of thermal efficiency.

With reference to the first-mentioned factor, that of fuel economy, it may be said that, in general, the Diesel engine should operate for a longer period for a given weight of fuel, but being a heavier engine, the combined weight of engine and fuel will be greater unless figured on the basis of flights of long duration. Consequently this condition is summed up in the statement that greater fuel economy is attainable over a substantial radius of operation.



Otto or constant volume cycle



The Diesel cycle

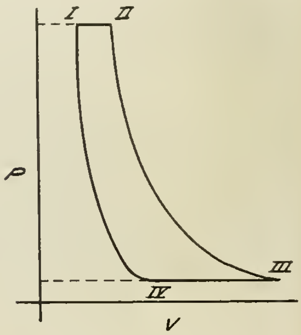
Fire hazard is reduced considerably because of the low volatility of fuel oil, the vapors of which will not ignite at atmospheric temperatures. The superiority of fuel oil as regards fire hazard opens up new possibilities in the field of lighter-than-air practice since hydrogen gas could be safely utilized and the helium supply problem thus obviated to a great extent.

Two-stroke cycle adaptation for aircraft engines has long appealed to designers, but due to complications arising from proposed applications of this principle to carbureted gasoline engines it has been reluctantly abandoned although the oil-engine offers the possibility of attaining an efficient, full load stroke from each cylinder for each revolution of the crankshaft. Elimination of the greatest inherent detriment to efficient two-stroke cycle operation is effected in that there are relatively low fuel losses through the exhaust ports, since only pure air is admitted to the cylinder during the exhaust gas scavenging period. Thus the oil-engine may be almost completely scavenged and almost completely filled with fresh air at, or higher than, atmospheric pressure with practically no direct loss of fuel during these processes. The lowered values of heat loss through the cylinder walls is reflected in the maintenance of thermal efficiencies as high as 32 percent.

Since the compression-ignition principle involved in the oil-engine eliminates all high-tension electrical ignition equipment, the operation of radio communication facilities is greatly simplified.

The increased severity of the explosion forces necessitates heavier construction of engine members with a consequent higher specific weight, as well as greater initial production costs. Rough running, and the imposition of excessively high loads on the crankshaft, represent further derogatory factors emanating from the above disadvantage, although effective measures have been employed in production practice to cushion the major members of aircraft oil-engines from shock loading. Advantage has been taken of the fact that the peak explosion pressures exist for a very short space of time in each cycle. The crankshaft counterweights have been flexibly mounted on the crankshaft, being pivoted on the cheeks and located between powerful compression springs instead of being rigidly bolted to these members. The counterweights consequently lag behind slightly when the crankshaft is suddenly accelerated so that the peak cylinder pressure is expended before the counterweights are again driven solidly by the crankshaft. In addition, the propeller is permitted to float on an extension of the crankshaft between rubber blocks, the inherent damping, or hysteresis (characteristic of these blocks) supplemented by the surface friction in the counterweight mounting, smoothing out the shaft rotation satisfactorily.

The outstanding problem in the field of high-speed oil-engine research has been to successfully coordinate moderate explosion pressures with the high degree of fuel economy peculiar to the slow speed engine. As the engine speed increased, the cylinder pressure increased proportionally, and since 400-500 lbs./sq. in. would be required for starting purposes and to keep the engine firing steadily at idling speed, the increased pressure at maximum speed would require so heavy a cylinder-wall construction that it would be impractical for aircraft adaptation. Measures taken to control this increase in pressure, such as late fuel in-



Constant pressure cycle

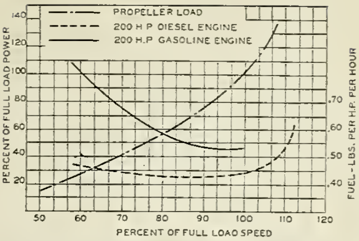
jection, or special cylinder head and piston design, resulted in a substantial reduction in fuel economy. This complication was successfully met by the Attendu principle, by means of which the compression necessary for self-ignition was retained within a full-range variation of 4 percent, or from 500 lbs./sq. in. at starting speed to 520 lbs./sq. in. at maximum speed, on a test engine used by the National Advisory Committee for Aeronautics.

The apparatus responsible for the above accomplishment consisted of a two-stage fuel pump having a bore-stroke ratio of 2:1, and a fuel injector having two concentric needle valves, the outer needle having an opening which, combined with that of the slow-speed needle, permits the injection of the maximum amount of fuel necessary for full load and speed at only a slightly greater pressure than that required for the slow speed adjustment. The tensions of the adjustable springs, used in conjunction with the needle valves, are so calculated that the slow-speed needle always opens before and closes after the high-speed adjustment. By this means of controlling the fuel injection, the formation of excessive peak pressures is prevented before expansion begins.

The objectionable features due to a single-opening injector, such as poor combustion and high fuel consumption at maximum load and maximum speed, and a smoky exhaust due to carbonization of the central portion of the jet of fuel, are removed by providing two openings through the manipulation of the needle valves. One opening is small enough to accommodate small charges of fuel for starting, and the other large enough to permit maximum injection of fuel for maximum load and maximum speed. It also permits the introduction of the central portion of the fuel jet into intimate contact with the combustion air, since a homogeneous mixture of fuel and air is insured by the turbulence set up by the heating of the incoming air due to the high velocity given to it by a restriction at the mixing-chamber mouth.

The requirements of aircraft are, chiefly, high fuel economy and low engine weight. The first factor is satisfied by the application of the Otto cycle which gives constant volume (sharp top) combustion; the second factor demands a high ratio of m.e.p. to maximum pressure or constant pressure (flat top) combustion which is the application of the Diesel cycle. The most efficient cycle is, therefore, a combination of the two termed the "mixed cycle" and commonly used as the operating cycle for high speed oil engines.

Three types of test apparatus proved effectual for securing data regarding high speed oil-engine performance.



Characteristic performance curves for typical gasoline and Diesel engines

(1) The maximum cylinder pressure indicator which consists of a gas-balanced disk which fits flush with the combustion chamber wall when the indicator is screwed into the cylinder head. In operation, when the pressure in the engine cylinder exceeds the gas pressure above the disk in the indicator, the disk is lifted from its seat and some cylinder gas trapped in the indicator. This process continues until a stable condition is reached, at which point the pressure is read from a calibrated Bourbon gauge.

(2) The oil-spray lag behind fuel pump adjustment and the duration and cessation of injection are obtained from the fuel injection test system. This apparatus consists of an electrically driven shaft and flywheel to which a paper target is fitted. Fuel oil is sprayed against this target, and from the spray record obtained the above determinations are made.

(3) The spray photography set consists of three essential parts, the oil-spray production and control apparatus, the oil-spray illuminating apparatus, and the oil-spray recording apparatus. With this set a photographic film without measurable distortion may be secured for oil spray having a velocity of 600 ft./sec. or more.

Looking to the future, the adaptability of the oil-engine to large units should prove advantageous to the present tendency toward large capacity transport craft design. One large central unit of 2000 h.p. or 3000 h.p. could replace several smaller units, being somewhat more accessible for detail inspection and repair, both on the ground and during flight, than these other isolated units. This last feature should practically compensate for any possible added dependability evolving from the use of several smaller units.

Lubrication of Aircraft Engines

●

● The reliability of the modern aircraft engine giving more than 500 hours of service between overhauls, necessitates consideration of the relative influence of oil consumption and the periods between overhauls on running costs, according to E. L. Bass in an article *Economics of Aircraft Engine Lubrication* which appeared in the July, 1935, *Shell Aviation News*. Both these factors, other things being equal, are controlled by oil quality, and while the ultimate aim must be to develop oils which give both minimum consumption and maximum periods between overhauls, there may be occasions when airline operators may be prepared to sacrifice one in order to obtain improvement in the other.

Just at what point is becomes economic to concentrate upon reducing consumption rather than upon increasing the overhaul period, Mr. Bass states, depends upon so many variables that each case must be considered separately. As a general guide, however, the following calculations may be used.

The operating costs for running an engine for 1000 hours (excluding the cost of fuel, which is a constant) are expressed by the following equation:

$K = 125\,cs + 1000\,a/p$ .... (1)

where:

c = oil consumption in pints/hour
s = price of the oil per gallon
p = number of hours between overhauls
a = cost of engine overhaul

The cost of overhaul a is composed of labor, material and overhead charges, and while the former and latter may be reasonably assumed to remain constant irrespective of overhaul period, the cost of materials will vary. For example some engine parts, having a normal life of 1000 hours, would not affect the cost of overhaul if the overhaul period was raised from say 400 to 500 hours, since a replacement would be necessary every two overhauls in either case.

On the other hand, if the overhaul period could be increased to something more than 500 hours, the replacement of the 1000-hours life parts would have to be made at each overhaul, thus increasing the replacement costs. Admittedly, with some engine parts this effect will benefit replacement costs, as in the case of a part having a normal life of 750 hours, its replacement costs per 1500 hours with 750-hour overhaul periods would be only 67% of that with 500-hour periods.

Clearly, the relative importance of replacement costs with varying overhaul periods depends entirely on the individual characteristics of engines and service conditions. For general purposes, however, the error will not be great if a constant figure for overhaul costs is taken.

Equation (1) can be expressed: $Q = (c + 1000/p)$ where:

Q is a function of K (operating costs) such that $K/Q = a$ constant for constant values of a/s.

The accompanying graph shows the relation between p (overhaul period) and c (oil consumption) for various values of Q. From this graph the monetary value of any improvement in consumption or overhaul periods can be calculated. For example, to estimate the reduction in operating costs that can be achieved by reducing the consumption from 6 to 5 pints per hour while increasing the overhaul periods from 400 to 600:

For $c_1 = 6$ pints/hour
$p_1 = 400$ hours
Q_1 (from graph) $= 2$
For $c_2 = 5$ pints/hour
$p_2 = 500$ hours
Q_2 (from graph) $= 1.45$

$\therefore$ Reduction in overhaul and lubricating oil costs $= 1 - 1.45/2.00 = 27.5\%$.

Other examples may be taken to ascertain whether with a given set of conditions it would be more economical to reduce oil consumption rather than increase overhaul period, e.g.:

$c_1 = 8$ pints/hour
$p_1 = 450$ hours
$Q_1 = 2.05$

Change to oil giving better consumption gives:

$c_2 = 5$ pints/hour
$p_2 = 450$ hours
$Q_2 = 1.70$

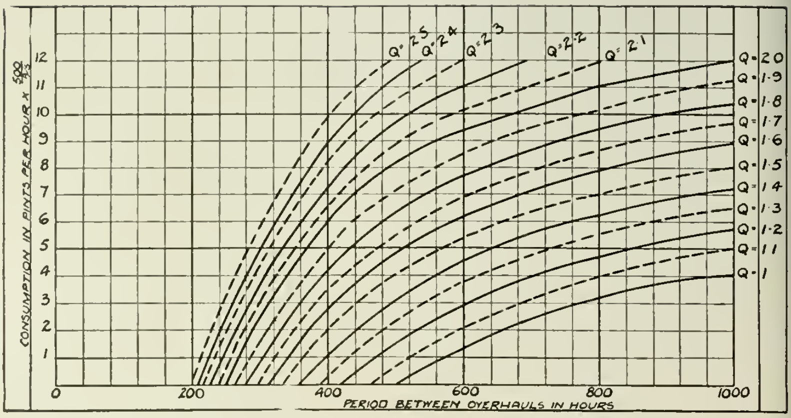
$\therefore$ Reduction in costs $= 17\%$

Change to oil giving increased overhaul period gives:

$c_3 = 8$ pints/hour
$p_3 = 750$ hours
$Q_3 = 1.65$

$\therefore$ Reduction in costs $= 20\%$

The curves given illustrate the fact that with engines of high oil consumption it is better to take steps to reduce this rather than to extend the overhaul period with the same oil consumption.



Graph, showing relation between engine overhaul period and oil consumption for various values of Q, for calculating money value of improvement in consumption

Recent Aeronautical Patents

●

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Apparatus for refueling aircraft in the air. Alan J. Cobham, London, England, assignor to Alan Cobham Aviation, Ltd., same place. (2,023,310)

Airplane. Louis Marmonier, Lyon, France. (2,023,334)

Propeller. Harry G. Warren, Pasadena, Calif., assignor to William H. Lyman, Inc. (2,023,454)

Variable pitch propeller for aircraft. Henry S. Hubbell, Dedham, Mass. (2,023,684)

Airplane hangar door for naval cruisers. Edward H. McCloud, Columbus, Ohio, assignor to General Door Co. (2,023,691)

Elevation beacon for aircraft and like. Henry I. Spring, Long Beach, Calif. (2,023,708)

Feathering paddle wheel (for aircraft). Carl B. Strandgren, Versailles, France. (2,023,750)

Interlock. George B. Thieme, Bloomfield, N. J., assignor to Eclipse Aviation Corp. (2,023,752)

Altimeter. Adolf Urfer, Richmond Hill, N. Y., assignor to Bendix Aviation Corp. (2,023,825)

Revolving wing or blade of aircraft. David Kay and John W. Dyer, Edinburgh, Scotland, assignors to Kay Gyroplanes, Ltd., same place. (2,023,840)

Airplane kite. Robert F. Talmadge, Springfield, N. J. (2,023,939)

Apparatus for testing shock absorbing struts for airplanes. Francis R. Shanley, Washington, D. C. (2,024,067)

Air propeller. Joseph D. Michaud, Santa Cruz, Calif. (2,024,241)

Reaction-propulsion method and plant. Secondo Campini, Milan, Italy. (2,024,274)

Altimeters. Adolf Urfer, Richmond Hill, N. Y., assignor to Bendix Aviation Corp. (2,024,313 and 2,024,314)

Parachute. John Kokoska, Cicero, Ill. (2,024,456)

Control system for brakes for wheels of aircraft. Frederick J. Tarris, London, England, assignor to India Rubber, Gutta Percha & Telegraph Works Co. Ltd. (2,024,649)

Starting device for lighter-than-air aircraft. Ernst J. Lehmann, Friedrichshafen, Germany, assignor to Lufschiffbau Zeppelin G. m. b. H. (2,024,587)

Gyrocompass. George R. Barker, U. S. Navy. (2,024,621)

Airplane. Edmund P. Gaines, Columbia, S. C. (2,024,853)

Airplane. Harry N. Atwood, South Lyndeboro, N. H. (2,025,033)

Course-changing means for automatically-steered ships. Frederick S. Hodgman, Glen Rock, N. J., assignor to Sperry Gyroscope Co. (2,025,054)

Radio course indicator. Paul Hermannspann, Berlin, Germany. (2,025,104)

Starter for an engine. Vera C. Hodges, Los Angeles, Calif., assignor to Eclipse Aviation Corp. (2,025,166)

Directional gyroscope. Edward B. Wilford, Merion, Pa. (2,025,561)

Venturi tube (for aircraft). Walter S. Diehl, U. S. Navy. (2,025,577)

Compass. Henry H. Engelhardt, Chicago, Ill. (2,025,580)

Amphibion landing gear. Frederic E. Flader and Donald C. Rowe, Kenmore, N. Y., assignors to Curtiss Aeroplane & Motor Co. (2,025,735)

Airplane attachment. John Grobling, Detroit, Mich. (2,025,739)

Retractable landing gear. Charles E. Hathorn, Hempstead, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,025,743)

Starter mechanism. Romeo M. Nardone, East Orange, N. J., assignor to Eclipse Aviation Corp. (2,025,884)

Earth inductor compass. Wladimir A. Reichel, Philadelphia, Pa., assignor to Pioneer Instrument Co. (2,025,897)

Airplane indicator. Harry H. Semmes, Chevy Chase, Md., and Montgomery W. McConkey, South Bend, Ind., assignors to Bendix Aviation Corp. (2,025,909)

Constant Speed on the China Clipper

Exhaustive tests proved the material contribution which Constant Speed Control could make to the performance and operating economy of the China Clipper and her sister ships.

A vital question remained.

Had this revolutionary Control been perfected to the point where it could be depended upon to assume its full share of the "most exacting task ever demanded of aircraft"?

The quick transition from the spectacular to the routine, from initial flight to routine service has supplied the answer.

HAMILTON STANDARD PROPELLERS, East Hartford, Connecticut
DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

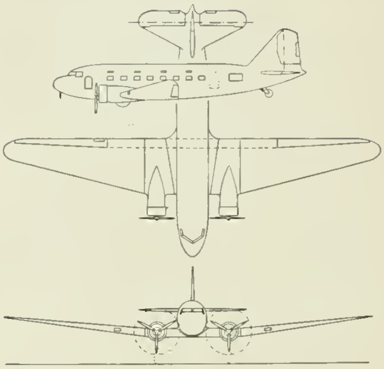
Douglas DST Sleeplane

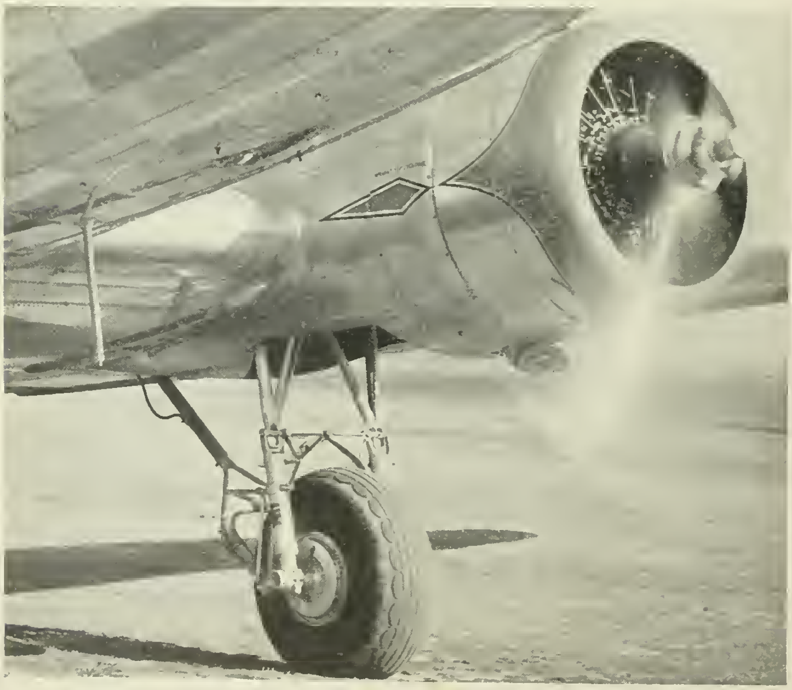
●

16-Place Transport for service over the Southern Transcontinental route

● Constructional details and performance figures additional to those included in AERO DIGEST's report of the new Douglas Sleeper Transport last month have now been released. As a sleeper transport the Douglas DST furnishes luxurious sleeping accommodations for 16 passengers. A similar airplane of the same basic structure, size and design, is the new Douglas DC-3, a "dayplane" which accommodates 24 passengers.

Faster and larger than the DC-2, the new sleeper transport is adaptable to long-range, high-speed flights because of its large fuel capacity and cruising speed performance at altitude.





Details of the new landing gear which uses oleo struts with a 10-inch stroke

Take-off run, take-off distance to clear obstacles and single-engine ceiling likewise are equal to or better than the DC-2, because of the DST's increased span, wing area, take-off rating of engine, three-blade constant-speed propellers and flaps that are depressible during take-off.

Optional power plants are G series Wright Cyclones and Pratt & Whitney twin-row Wasps of the SBG type, although American Airlines may specify the former for its planes which are now under construction. These Cyclones have two speed blower gears, one (7.14:1) providing 850 h.p. at 2100 r.p.m. at 4300 ft., with 930 h.p. available for take-off.

This is the type of engine Howard Hughes used in breaking the transcontinental speed record by 35 minutes. Hughes got 700 h.p. at 15,000 ft., and 600 h.p. at 18,000 ft.

With the higher altitude rating, the Cyclone (10.1 blower gear) develops 800 h.p. at 2100 r.p.m. at 11,500 ft. The Twin Wasp SBG with 850 h.p. at 2450 r.p.m. at 8000 ft. has 950 h.p. available for take-off.

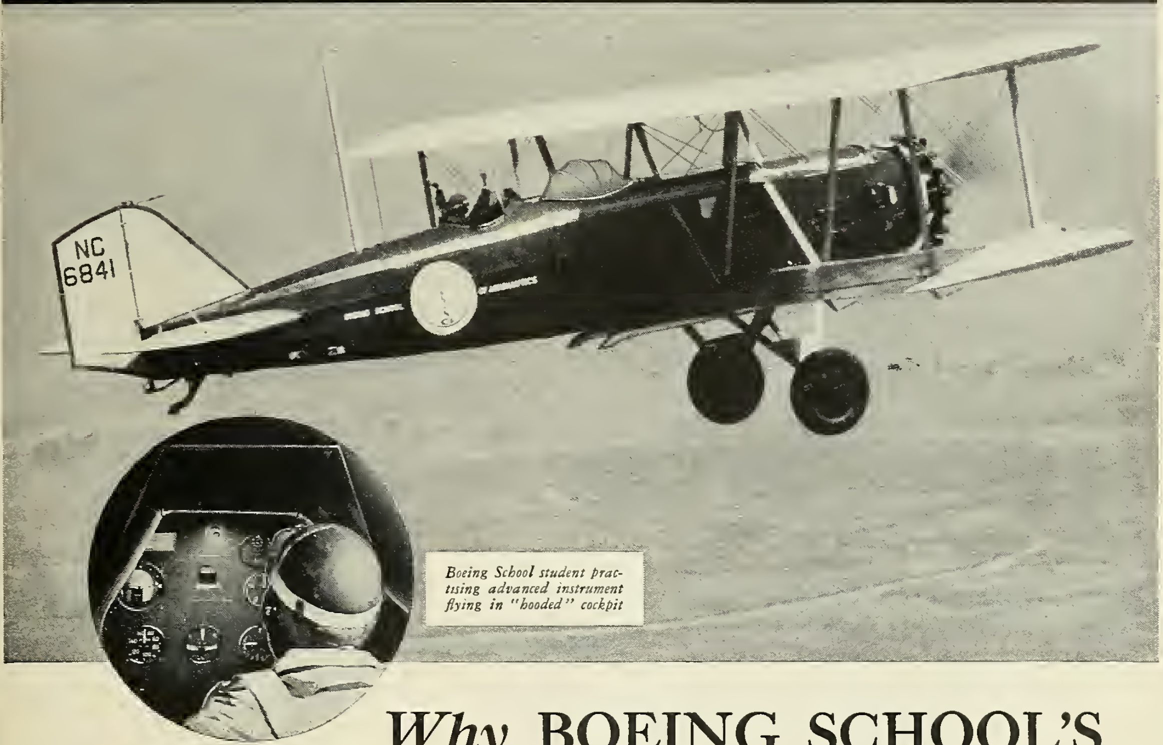
Fuselage construction follows monocoque design constructed principally of Alclad 24S-T and 24SR-T aluminum alloy, aluminum coated. Although it has been enlarged and widened, the fuselage presents no more drag than the DC-2. The rounded, streamline shape shows improved aerodynamic characteristics, and the slight increase in drag of the entire airplane over the DC-2 is due to the larger wing, control surfaces, tires and engines.

Internal arrangement of the fuselage provides a control compartment forward, aft of which is a combined mail and cargo compartment of 35 cu. ft. capacity on the right and a completely equipped buffet on the left.

Aft of the passenger cabin are two dressing rooms with adjoining lavatories, behind which is a 107 cu. ft. baggage compartment.

(*Continued on following page*)

40 HOURS "under the hood"



Boeing School student practising advanced instrument flying in "hooded" cockpit

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FIRST OF ALL, a word of advice: Take plenty of time in selecting your air school. *Itemize exactly what you get for each hour and each dollar you put in.*

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Chief Pilots Addems, Williams, Lewis

Three of the United officials who help plan Boeing School courses

Static wing-rib test

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And you get *250 hours* of dual and solo instrument and beam flying in 11 different planes. You fly 9 distinct types—from modern 165 h. p. trainers to a 1350 h. p. transport, the largest in any school in the United States.

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(*Continued from preceding page*)

Divided into eight sections, four on each side of a wide aisle, the cabin interior measures 6.5 ft. high, 7.75 ft. wide and 26 ft. long. Two 36 in. wide deeply upholstered seats, facing each other in each section, make up at night into a lower berth, while an upper berth, 32 in. wide, folds up into the ceiling during the daytime. Made up for sleeping, the berths are 6 ft. 5 in. long between partitions.

Each passenger seat in the daytime and each berth at night is provided with windows, ventilators, reading lights, call buttons and other conveniences.

Air ducts in each compartment provide a sufficient flow of warm air during cold weather to maintain a cabin temperature of 70° F. when the outside temperature is -20°.

The 95-ft. wing (10-ft. greater than the DC-2), is of Alclad cellular, multi-web construction, consisting of outer panels with detachable tips and a center panel which is integral with the fuselage. The center panel mounts the nacelles, retractable chassis and fuel tanks which carry 820 gallons.

Trailing edge flaps are of the split type, extending along the center wing panel and the outer panels to the ailerons. They are hydraulically operated.

Elevator, rudder and right aileron are provided with trimming tabs controllable in flight from the cockpit.

For softer landings the DST is equipped with a landing gear of new design. While embodying the features of the DC-2 gear, the gear of the sleeper transport incorporates a new type oleo strut with 10 in. stroke, which is 4 in. greater than the DC-2. An additional improvement in the landing gear is the introduction of a new linkage which transmits into the absorber much of the landing shock previously taken by the rear brace strut.

The hydraulic system which operates the landing gear retracting mechanism also operates the automatic pilot, braking system and flaps. Of the constant flow type, the system is actuated by engine driven pumps, but an auxiliary hand pump is provided for emergency operation.

Aft of the pilots' compartment, the interior of the DC-3 differs considerably from that of the sleeper transport. Directly behind the control compartment on the right is a combined mail and cargo compartment, while on the left, instead of a buffet, is an additional mail compartment.

Aft of the passenger cabin are a buffet and a lavatory, behind which is a baggage compartment of 151 cu. ft. capacity.

In the DC-3 passengers are seated in roomy chairs adjustable to the reclining position, the cabin being arranged in 8 rows of 3 seats each. A wide aisle separates a single row of 26-in. seats on the right from a double row of seats on the left. Each of the double seats at the left is equipped with a center arm rest which may be removed to convert the double seat into one wide single seat.

Dimensions of both models are identical, as are weights, with the exception of useful load which is 8250 lbs. in the DST, and 9155 lbs. in the DC-3. Performances are given with the plane fully loaded at a gross weight of 24,000 lbs.; ceiling on one engine (10:1 blower gear) is 9400 ft., but this can be increased to 11,500 ft. after dumping 330 gal. of fuel. Cruising and maximum range given are for maximum fuel capacity of 820 gal.

Specifications

Wing span	95 feet
Overall length	65 feet
Overall height	16.3 feet
Wing area	987 square feet
Dihedral	5 degrees
Empty weight	15,750 pounds
Gross weight	24,000 pounds

Engines and Performances

Engine	G-5	G-5	SBG
Blower gear ratio	7.14:1	10:1	11.9:1
Total horsepower	1700	1600	1700
R.P.M.	2100	2100	2450
Critical altitude (ft.)	4300	11,500	8000
Total take-off power	1860	....	1900
Propeller shaft ratio	16:11	16:11	3:2
Maximum speed at critical altitude (m.p.h.)	212	219	216
Cruising speed at 10,000 ft. at 1100 h.p. (m.p.h.)	184	184	181
Landing speed (m.p.h.)	65	65	65
Rate of climb (ft./min.)	970	....	1020
Service ceiling (ft.)	19,900	23,300	23,100
Absolute ceiling (ft.)	22,100	25,200	24,100
Ceiling on one engine (ft.)	5000	9400	8000
Cruising range (mi.)	1790	1710	1690
Maximum range at 10,000 ft. (mi.)	2150	2050	2020
Take-off run (ft.)	1000	....	940
Landing run (ft.)	950	950	950

Composite Aerodynamic Charts As Practical Aids to Calculations

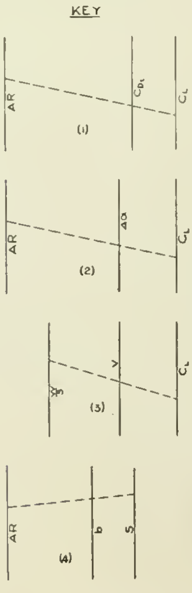
●

LIEUT. COMDR. W. F. EADE, USNR

Chief Statistician, Division of Airways & Airports, WPA

● On numerous occasions it is necessary for the aeronautical engineer to determine induced drag and angle of attack, horizontal flying speed for a given lift coefficient, and the relationship of aspect ratio span and wing area.

The basic formulae are well known and generally used, and since they involve a single setting on the slide rule, it may seem that the inherent simplicity of the computations involved hardly merits the need of charts. While this is admittedly true there is, however, much to be said in favor of using the charts presented here. Since the wing characteristics are normally presented in absolute coefficients while other factors involved are in square feet, pounds, and miles per hour the application of the charts, obviating the use of transformation coefficients, will be found expedient in many instances. This is particularly true also in the case of the determination of the induced drag coefficient where the error in the decimal point is a troublesome possibility.



Key to Aerodynamic Charts

In addition, the chart provides a device that allows a simple quick change of one variable in an equation and determining the effect this change has on the other variables and the answer without the necessity of continuously tabulating these results.

The four charts presented enable a rapid determination of the induced drag from the expression

$C_{Di} = C_L^2/piA.R.$ ....(Figure 1)

induced angle of attack in degrees

$\Delta\alpha = 57°.3\ C_L/piA.R.$ ...(Figure 2)

horizontal speed for a given wing loading and lift coefficient

$V = \sqrt{W/SK\ C_L}$........(Figure 3)

wing area for a given span and aspect ratio. (K is conversion factor.)

$S = b^2/A.R.$ ....(Figure 4)

In the last cases the quantities to be determined and given may be reversed but the determination is, of course,

TABLE I

Tapered Airfoils			Rectangular Airfoils		
Tip chord / Root chord	Tau	Sigma	A.R. × $(d\alpha/dC_L)$	Tau	Sigma
0	.160	.110	1.70	.10	.019
.25	.005	.010	2.22	.14	.034
.50	.033	.008	2.74	.17	.049
.75	.092	.023	3.26	.20	.063
1.00	.170	.049	3.78	.22	.076

similar in operating procedure.

The number of problems requiring the determination of the quantities involved is large and to cite some, one may mention the conversion of wing characteristics from one aspect ratio to another, comparison of wing sections, performance calculations, tabulation of data, etc.

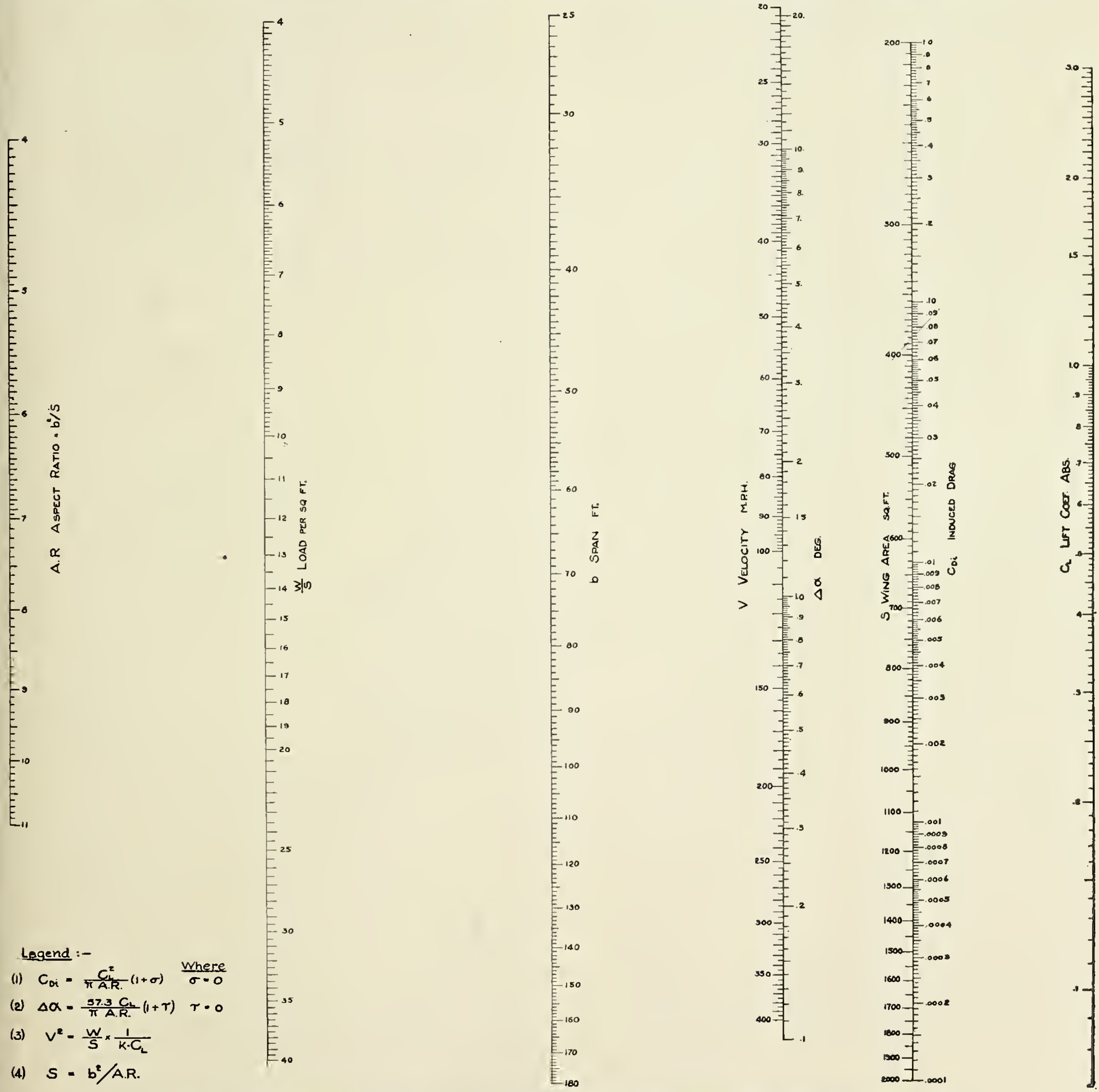
It will be noticed that the expression of the induced drag coefficient and angle of attack as given in the nomographic chart are extended to include Glauert's correction factors *tau, sigma*. The introduction of these coefficients is found necessary for all wings which do not have an elliptic lift distribution and for convenience these functions are given in Table I. They apply to tapered and rectangular untwisted airfoils.

For all practical purposes, the expression of the induced drag coefficient as applied to biplanes can be taken as given by the general expression on the chart. The value *sigma* may be determined from Table II where G is the gap while b_1 and b_2 are the spans of the upper and lower wings.

TABLE II: Biplanes—values of sigma

$2G/(b_1+b_2)$		0	.05	.10	.15	.20	.30	.40
b_1/b_2	1.0	1.000	.780	.655	.561	.485	.370	.290
	.8	.800	.690	.600	.523	.459	.355	.282
	.6	.600	.540	.485	.437	.394	.315	.255

In conclusion it may be stated that the accuracy which these charts afford is believed to be ample for all practical purposes and the time saving (particularly when a considerable number of determinations are required) strongly recommends the use of this expedient method



Legend :—

Where

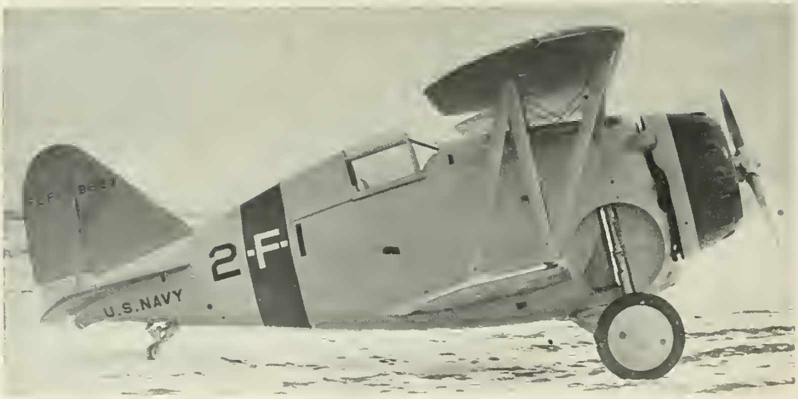
(1) $C_{Di} = \frac{C_L^2}{\pi\,A.R.}(1+\sigma)$ $\sigma = 0$

(2) $\Delta\alpha = \frac{57.3\ C_L}{\pi\ A.R.}(1+\tau)$ $\tau = 0$

(3) $V^2 = \frac{W}{S} \times \frac{1}{K \cdot C_L}$

(4) $S = b^2/A.R.$

Aerodynamic charts for calculating induced drag, induced angle of attack, horizontal speed, wing area, etc.



Grumman F2F-1 Single Seater Fighter

●

● One of the newest single seater fighters for the U. S. Navy is the model F2F-1 manufactured by the Grumman Aircraft Engineering Corp., of Farmingdale, N. Y. Construction follows usual Grumman practice with the fuselage being of the all-metal semi-monocoque type; wing ribs and spars of dural, fabric-covered; and all-metal dural fin and stabilizer. Rudder and elevators are of the metal frame fabric-covered type.

The wing cell has an *N*-type interplane strut bracing and a single interplane truss system with streamline flying wires extending from the fuselage to the rear apex of the *N* brace. Landing wires run from the upper attachments of the rear cabane member to the front lower *N* brace. The upper wing consists of two panels hinged in the center and attached to the fuselage by means of two cabane struts on each side with a cross bracing in each side. Side bracing of the upper wings and cabane is achieved by means of single wires extending from the fuselage points to fittings at the corresponding points of attachment of the cabane struts to the upper wing panels. The lower wing consists of two outer panels attached to the fuselage.

Horizontal tail surfaces are strut braced by means of a single strut member attaching to the rear beams of the fin and stabilizer.

The pilot's cockpit is protected by a cabin enclosure of the sliding canopy type. The windshield portion is of non-shatterable glass, the balance being pyralin. Conveniently located doors in the fuselage enable easy access for maintenance and inspection. A starboard compartment accessible from the outside contains the crank handle, baggage space, radio, cockpit and engine covers, first aid and tool kits, and emergency rations and water.

Tankage is provided for 9½ gals. of oil and 110 gal. of fuel, sufficient for a cruising range of 650 miles.

The Grumman type landing gear is fully retractable into wells in the sides of the fuselage, these wells being immediately forward of the leading edge of the lower wing. Operation of the landing gear is manual. The tail wheel is fully retractable and for easy maneuverability on the ground is also fully swivelling through 360°.

Goodrich 30 × 5 tires are standard equipment on the landing gear. These are mounted on Bendix wheels and are equipped with Bendix mechanical brakes. Shock absorbers are also of Bendix manufacture and are of the pneumatic type. Landing lights are fixed in the lower forward section of the fuselage and are of the A-6 type manufactured by Adams and Westlake.

Power is supplied by a Pratt & Whitney Twin Wasp Junior rated 650 h.p. at 2200 r.p.m. at 7500 ft. The engine, enclosed in a full NACA cowl, is equipped with a Lycoming Smith controllable pitch metal propeller with a diameter of 8½ ft. and an overhead ramming type carburetor air intake is used.

The plane is provided with two fixed machine guns located in the cockpit and fired through the propeller disc. Ammunition is loaded from the outside by means of appropriate doors.

Specifications of the Grumman Navy model F2F-1 are as follows:

Wing span	28 ft. 6 in.
Overall length	21 ft. 1 in.
Overall height	8 ft. 6 in.
Wing area	230 square feet
Power loading	5.74 lbs./h.p.
Wing loading	16.25 lbs./sq. ft.
Weight empty	2575 lbs.
Useful load	1160 lbs.
Gross weight	3735 lbs.
Maximum speed	240 m.p.h.
Landing speed	66 m.p.h.
Rate of climb	2000 ft./min.
Service ceiling	28,000 ft.

PROPELLER DE-ICER

(*Continued from page* 43)

ring to keep the airstream from the fluid. Once in the revolving ring, centrifugal force holds the fluid in the trough, forcing it out through the distributing pipes to the blades. This part of the device is similar to the system sometimes used to lubricate the crank-throws on large stationary engines. The short distributing pipes are connected to the ring and curve around the propeller shank, feeding the fluid out at a critical point on the shank of the blade. This point is within the protection of the spinner and is lined up with the leading edge of the blade.

The nose spinner is an essential part of the system. It keeps the hub free of eccentric masses of ice, and also prevents ice from forming in the annular ring and distributing tubes during periods of inoperation. In order to prevent the outlet ends of the distributing pipes from being blocked by ice, they should be within the protection of the spinner.

Partial operation with one or more distributing pipes clogged would be worse than complete failure due to the unbalanced condition which would be set up, and should be guarded against in all installations.

Experimental work was carried out jointly by the B. F. Goodrich Co., and TWA, Inc., under the sponsorship of the Bureau of Air Commerce. After development under simulated icing conditions in the Goodrich refrigerated wind tunnel, practical flight tests were made with Douglas DC-1 #300, TWA's "Flying Laboratory." For purposes of comparison, one propeller was fed Pine oil on the old type rubber covers; on the other, an alcohol mixture was fed to the bare blade. Both methods fnnctioned effectively under the severest icing conditions encountered. The alcohol mixture was preferred, because in addition to eliminating the need for rubber covering, it was highly effective in removing ice that had formed.

The fluid considered most suitable is one containing 85% alcohol mixed with 15% of glycerine to give it body. Between ½ and 1 gallon per hour has proven sufficient to keep a large 3-bladed propeller de-iced.

An interesting feature of the test flights was the difficulty in finding icing conditions. Cloud areas with temperature and moisture conditions so evidently conducive to icing that they were being shunned by other aircraft, did not always cause ice to form. On one prolonged flight through severe conditions, ice was built up to a depth of from 6 to 8 inches on the nose of the ship, and on the wing tips beyond the area protected by the wing de-icers. The fin antenna wire was iced up until it was 5" in diameter, but the slinger ring kept the propellers so clean that the engines ran smoothly at all times, and lost no power.

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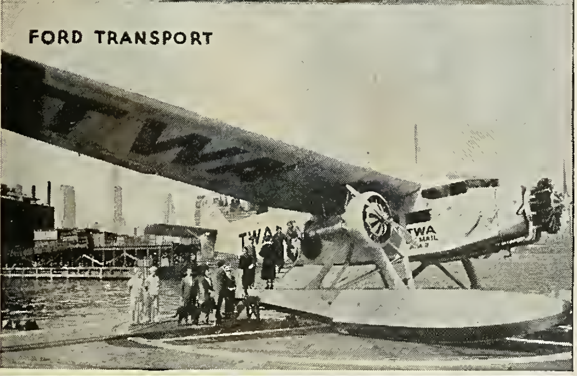
FORD TRANSPORT

GIANTS of the SKY are EDO-EQUIPPED

To increase their usefulness economically and widen their range of operations, an increasing number of large planes, passenger and military, are being converted for seaplane use with Edo Floats.

The operating advantages of Edo-equipped seaplanes are important. Well above the water, passengers are both isolated and insulated from the noise and shock of waves. Their vision is never obscured by spray. Submerged obstacles, if struck, do no harm to the plane itself. Edo Floats are divided into as many as 22 permanently built-in watertight compartments—they are safe. If a float is damaged the ship may still be kept in service by quickly installing a temporary replacement float, while float repairs are efficiently made in the shop.

Large seaplanes, Edo-equipped, are easily handled. When taxiing at slow speeds, steering is facilitated by EDO's patented automatic water rudders. Docking is quickly accomplished, without large handling crews, by sliding the seaplane out of the water on the keels of its rugged floats.

For military use, the convertibility of seaplanes into land planes at will, doubles the utility of any given number of machines. Bombers, moreover, can utilize the standard, or fuselage, bomb bay. For long flights, reserve gasoline tanks may be fitted into the floats—requiring no change of armament facilities.

There are available today a number of large transport planes which can be changed over quickly and economically into efficient seaplanes with Edo float gear. Persons interested will receive complete information.

EDO AIRCRAFT CORPORATION
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8-Place Bimotored Lockheed 12 Series For Feeder-Line Operations

●

Photographic conception of the Lockheed 12 as it will appear in flight

● Developed to give the private owner, business man, industrial concern and small airline operator an economical airplane which combines the features offered by modern airliners with greater speed, the new Lockheed 12 series has been announced by the Lockheed Aircraft Corp.

This plane, which soon will make its appearance at the Burbank factory, is an 8-place, all-metal low-winged, twin-engined machine similar to, but smaller than, the Electra. It has a wing span of 49.5 ft., an overall length of 36.3 ft. and shows better speed and all around performance than its larger counterpart.

Four Models Available

Based on three years of research, test and service with the 12-place Electra, design and construction of the Lockheed 12 represents an advanced degree of refinement and construction. Equipped with two 450 h.p. P. & W. Wasp Junior SB engines the new plane has a maximum speed of 231 m.p.h. at 5000 ft. Cruising speed is 209 m.p.h. at 9600 ft., and ceiling with full load is 27,000 ft. With 60% power and with a fuel consumption of 39 gal./hour, the plane has a cruising range of 650 miles. Take-off run with a 2-position propeller is 780 ft., and with a constant speed propeller, 600 ft. Powered with these engines the plane will be known as Model 12A. Each engine has available for take-off 450 h.p. at 2200 r.p.m., with 300 h.p. available at 2000 r.p.m. for cruising. There will be three other models, each powered by a different set of engines. Model 12B uses 9-cylinder model R975E3 Wright Whirlwinds. Intended primarily for sea level operation, these engines have 440 h.p. for take-off and 300 h.p. for cruising. Model 12F is constructed to operate with 7-cylinder Wright Whirlwinds of lower horsepower ratings, and Model 12M, is powered by two Menasco 6-cylinder engines of 290 h.p. each, with 195 h.p. each available for cruising.

Constructed principally of Alclad 24S-T aluminum alloy, aluminum coated, the Lockheed 12 has a monocoque fuselage and skin-stressed wing. The twin fin and rudder arrangement, which has enhanced stability and controllability of the Electra, has been further developed and refined for the new Lockheed.

The fuselage has approximately the same cross-section as the Electra, thus offering the same degree of comfort and roominess for passengers. Length of the passenger cabin including pilots' compartment is 14 ft. 8 in. Maximum width of the cabin is 5 ft. Maximum height is also 5 ft., and total volume is 285 cu. ft. Aft of the fuselage are lavatory facilities and a 33 cu. ft. baggage compartment.

The cabin is completely soundproofed and employs the Electra system of ventilation. In airline service, there will be accommodations for six passengers in adjustable seats, a crew of two and 450 lbs. of cargo stored in the rear compartment and in the nose which contains 30 cu. ft. of space for storage purposes.

Construction Details

Wing construction is of the semi-stressed skin type, with a single shear beam. The wing is readily accessible and repairable. Split-type trailing edge wing flaps increase the gliding angle and reduce the landing run. The entire wing, as are all surfaces, is of metal, the exterior surface being smooth to reduce resistance. Heavy corrugations under the skin increase strength.

Center section is cut away at the fuselage, permitting the fuselage to be placed partly within the wing. This gives a small frontal area, and reduces drag. Smooth design of the nose and forward part of the cabin minimizes drag and the sloping, streamline construction also affords maximum visibility for the pilots. Tankage is provided for a maximum of 140 gal. of fuel and 14 gal. of oil. Normal fuel capacity is 110 gal.

For the private owner, the Lockheed 12 offers smaller initial cost coupled with low operating expenses for an airline type airplane. For the airline operator, the plane will be a suitable flying companion to the Electra in feeder-line operation.

In addition to its use on airlines and by private concerns, the Lockheed 12 can be used by governmental agencies and has possibilities as a staff plane for the personnel of military and naval forces, according to Robert E. Gross, Lockheed president.

With the addition of this smaller passenger plane, Lockheed now has a full line of modern multi-engine aircraft for supplying independent airlines, secondary services of major airlines, and the private owner or business organization.

Specifications of the Lockheed 12A and its estimated performances with the P. & W. Wasp Junior SB engines and with full load are as follows:

Specifications

Wing span	49 feet 6 inches
Overall length	36 feet 4 inches
Overall height	9 feet 9 inches
Wing area	352 square feet
Power loading	8.81 lbs./h.p.
Wing loading	22.5 lbs./sq. ft.
Landing gear tread	13 feet 6 inches
Empty weight	5355 pounds
Useful load	2570 pounds
Gross weight	7925 pounds

Estimated Performances

Maximum speed (sea level)	219 m.p.h.
Maximum speed (5000 ft.)	231 m.p.h.
Cruising speed (sea level)	192 m.p.h.
Cruising speed (5000 ft.)	201 m.p.h.
Cruising speed (10,000 ft.)	209 m.p.h.
Landing speed (flaps down)	65 m.p.h.
Service ceiling	24,800 ft.
Absolute ceiling	27,000 ft.
Absolute ceiling (one engine)	10,200 ft.
Cruising range (60% power)	650 miles
Rate of climb	1400 feet per minute

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EQUIPMENT and METHODS

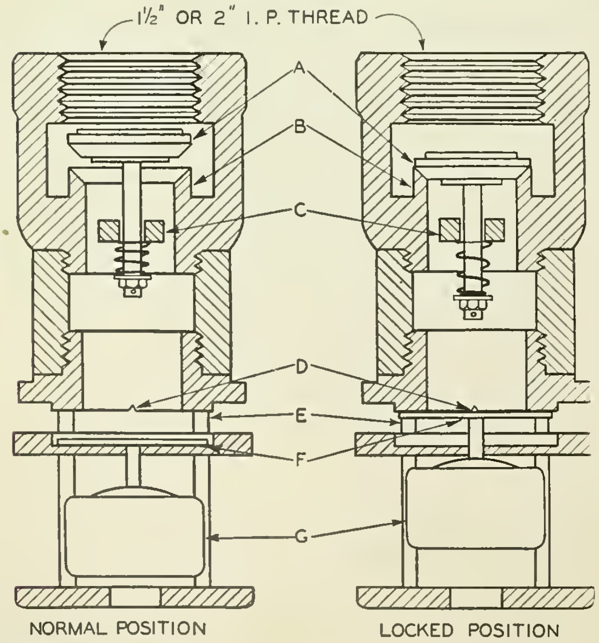
Automatic Water Trap Valve

A safety valve, designed to automatically keep water from being pumped into airplane tanks along with gasoline, has been developed for aircraft use by the Swift Lubricator Co. It is known as the Viele Water Locking Foot Valve. Rust, scale, dirt or water will not remain suspended in the gasoline. These accumulate at the bottom of a tank, and while a tank is primarily for storage, it also acts as a settling tank for foreign material.

The principle involved in this valve is a balanced float that sinks in gasoline, and floats in water. The weight of the float assembly is the weight of water displaced making the float buoyant when water is at a point approximately ⅛" from the top of the float.

The valve is attached to a suction stub with a clearance of at least ½" from the tank bottom. The intake of the valve is from the side and with the float buoyant and in the locking position when the water level comes near the area of suction, all accumulation at the tank bottom is kept out of the system.

Besides the safety factor, use of this valve will keep the accumulation of water and foreign matter from entering the dispensing system, thereby preventing clogged lines, premature wearing out of pumps and meters, and frozen lines and equipment. Valves are available in 1½" and 2" sizes, with both larger and smaller sizes contemplated.

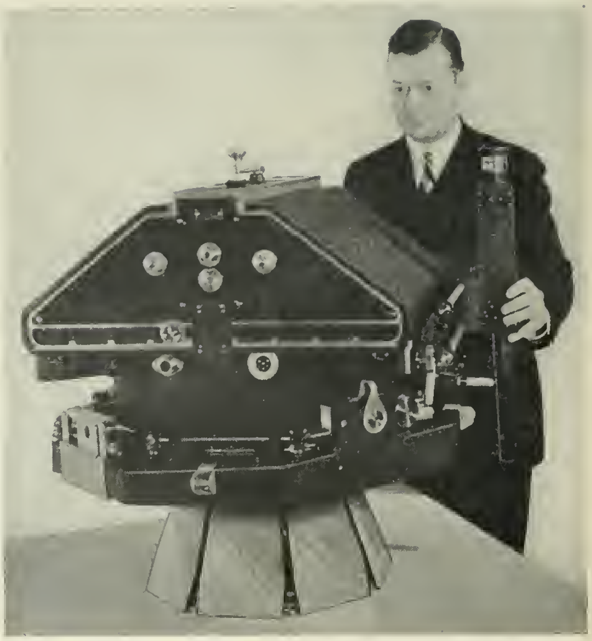


Viele water locking foot valve showing A—check, B—dirt pocket, C—guide, D—release vent, G—intake, F—shut-off plate, G—balanced float

Nine-Lens Camera

A nine-lens aerial camera, designed by Lieut. O. S. Reading, of the Coast and Geodetic Survey, and by engineers of the Fairchild Aerial Camera Corp., is being delivered to the Coast and Geodetic Survey for use in its national mapping program.

The camera has nine vertically mounted F4.0 lenses, eight of which have associated steel mirrors of high reflectivity, weighs 305 lbs. when loaded, stands 38 in. high, has a maximum diagonal cross-section of 35 in., and has one large film for all lenses. The weight of the camera and accessories needed for a photographic flight totals 636 lbs. Its features include automatic operation and low operational costs. It can be loaded in daylight, and after the camera is in operation, the photographer has only to keep the camera level by two spirit levels.



Sherman Fairchild and the new nine-lens aerial camera

It largely eliminates the need for adjusting radial line plots, an expert and lengthy laboratory procedure by which photographs are assembled into mosaics in accordance with ground control points. It has 4½ times the stereoscopic parallax of the single lens and five lens cameras, making it practical to extend the advantages of stereoscopic mapping (securing contour maps for aerial photographs) to more level terrain than is possible with present equipment as well as reducing the cost of topographic mapping considerably below present levels. From a working altitude of 30,000 ft. above sea level the camera can cover about 600 sq. mi. at one exposure. The camera has another advantage in that by virtue of its single film for all the lenses there is but one transforming process.

Because of its 8.25 in. focal length it provides the advantages of multi-lens equipment for mapping from altitudes which hitherto have been practical only for single lens cameras.

The camera consists of three main sections. On top is the film magazine and associated operating mechanism. The top of the magazine resembles a low-pitched roof. Below that is the chamber in which are the nine vertical lenses and underneath that are the eight astronomical type mirrors, one for each of the wing lenses.

Each of the eight astronomical mirrors is coated with evaporated aluminum and is 9½ in. long, 5 in. wide and 5/16 in. thick. They are supported on an alloy steel frame, slanting outward at an angle of 19° from the vertical and set at an angle of 45° to each other, forming an octagonal cone wider at the bottom than at the top.

Each of the nine shutters is actuated by an individual electric motor rather than by mechanical or electrical release mechanism; all nine motors operate in synchronism, assuring simultaneous operation of the shutters.

The negative size is 23 in. square, and the composite prints made from this negative are each 35 in. square.

For actual photography the camera is lowered on its mount by a block and tackle installation fixed to the cabin roof so that the mirrors extend 8 in. below the bottom of the fuselage.

A metal shield is installed on the bottom of the fuselage about 4 ft. in front of the mirrors for protection while in the extended position. This eliminates direct slipstream blast. It is loaded into position on the plane with a worm-geared winch and pulley.

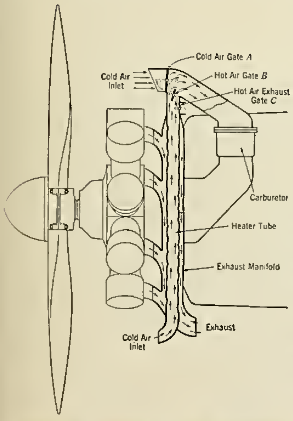
An important element of the camera is the automatic telescopic sight attached to the side. The sight includes hair lines which form a grid and enable the photographer to detect the degree the camera must be turned on its mount to compensate for the plane's drift, so that each exposure will be made with two sides of the film parallel with the line of flight. A moving wire, which can be regulated for any overlap from 10% to 75%, moves across the grid and automatically operates the switch controlling the shutter action.

Carburetor Ice Eliminator

When moisture laden air, at temperatures relatively close to freezing, enters the carburetor the moisture tends to condense and freeze. Ice, continually forming around the air intake venturi, reduces the air supply so that the fuel supply is restricted to a point where the motor suffers a loss of power, or, in some cases, may even stall.

For some time Eastern Air Lines made a study of this problem. As the result of their investigations and with the cooperation of H. E. Davies, chief engineer of the Pollak Manufacturing Co., they have designed an exhaust collector which serves also as a heating medium for the carburetor air intake line. This is so controlled that the mixture of the hot and cold air can be regulated to keep the carburetor air temperature above freezing and within a normal operating range. The accompanying sketch gives a general outline of the design of the manifold, heater and control. The cross-sectional view of the manifold shows the heater tube ascending through the manifold to the air scoop. The hot air gate *B* is open permitting preheated air to enter the carburetor while cold air gate *A* and hot air exhaust gate *C* are closed, the former shutting off the entrance of cold air, and the latter completing the unbroken path of the pre-heated air. When these interconnected gates are reversed, gate *B* closes, and gates *A* and *C* are open, gate *A* directing cold air to the carburetor and gate *C* exhausting the pre-heated air to the atmosphere so that the heater tube will not be subjected to elevated temperatures when unnecessary.

A problem of materials entered the development of the new device. It was necessary to select a material that would retain its strength and ductility at high temperatures, resist corrosion from burned dope gasoline, vibration, rapid temperature changes, and atmospheric corrosion. This material had to be practicable from the manufacturing angle inasmuch as the manifolds are formed into complicated sections and welded. The temperature of the exhaust manifold reaches a maximum under normal operation of between 1200°F. and 1400°F. Any material that tends to distort, warp, scale, or suffer from other deterioration at such heat obviously is out of the question for this type of application. To meet this problem of materials Inconel was finally specified. This material has the corrosion resistance common to all of the high nickel alloy group and, in addition, 3600 hours of testing in cabin heaters confirmed its heat-resistant properties.

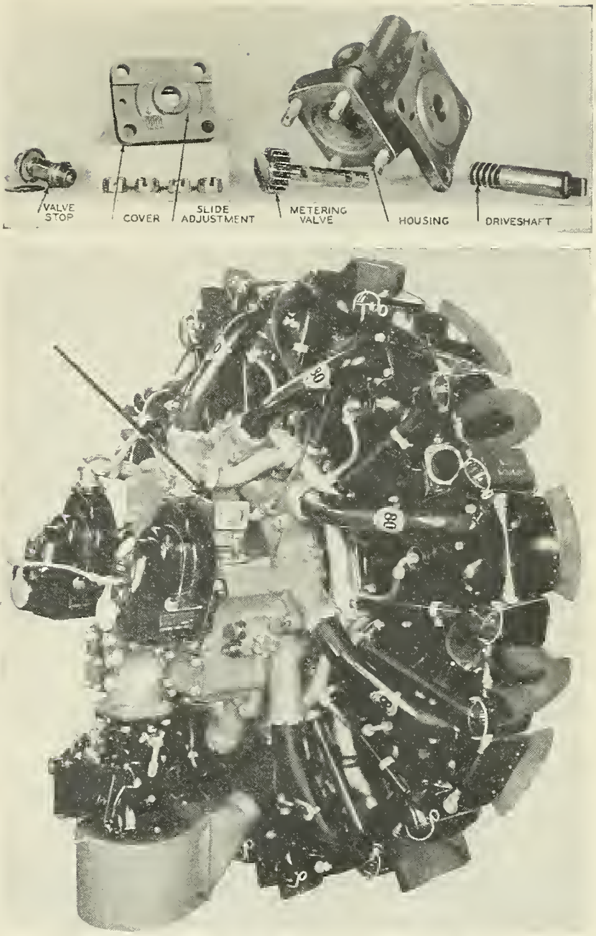


Outline of carburetor ice eliminator

Valve Gear Lubricating Pump

Wright Aeronautical Corp., has developed an automatic valve gear lubricating pump which the operator of Whirlwind and Cyclone engines can utilize in place of the control valve on his production model, in order to simplify the problem of valve gear lubrication, to eliminate manual operations, and to decrease maintenance costs. The new unit is simple in design and can be adjusted to provide a flow ranging from 0 to 3 pt./hr. Through it, engine oil is led by an external line to the No. 1 cylinder, from where the oil is fed through a system of tubes connecting all cylinders in a complete circuit. The quantity of lubrication entering the valve gear lubricating system coincides with that consumed, and no surplus oil is returned to the main supply.

The driveshaft, located in the mounting flange of the lubricator housing, is engaged on the engine accessory drive by its torque end. The driveshaft worm drives the valve shaft gear which is in the main part of the housing at such an angle to the worm shaft that the drive gear teeth are straight. The valve stop consists of an adjustment screw and a ball end. This is inserted in the slide adjustment which moves in a slot provided in the cover. The whole is fastened to the housing by studs. The ball end of the valve stop contacts the angular end surface of the valve shaft causing the shaft to reciprocate as it rotates. The length of the stroke (and therefore the oil volume displaced) is determined by the amount of off-set of the ball from the valve shaft center which is indexed on the cover and slide adjustment. A spring and plunger are inserted in the end of the housing opposite the gear chamber to maintain proper contact of the valve against the ball adjustment.



Parts of valve gear lubricating pump, and its installation in one of the new Wright Whirlwind engines

Pressure oil from the engine enters the lubricator by any one of the four holes in the mounting flange depending on the manner in which the lubricator is assembled on the engine. The oil flows through a drilled passage in the housing to the valve stem bore, where the slot farthest from the gear admits a sufficient quantity of oil to the axial hole in the stem to fill the cavity. Reciprocation of the valve forces the oil out into the distributing system when the second slot on the valve stem coincides with the lubricator outlet which is a tapped boss on the top of the housing.

Variation in the indexing of the slide adjustment on the cover provides for the regulation of the valve stroke thus controlling the amount of oil entering and leaving the slots in the valve stem.

The lubricator may rotate in either direction, provision being made for proper valve action by reversing the position of the cover with its slide adjustment.

Plexite Safety Glass

The American Window Glass Co. has developed a safety glass which is flexible enough to dent or yield on impact, yet has sufficient strength to resist penetration. It shows increased resistance to spalling or scattering of glass particles, and when penetrated reduces the speed of the missile to harmless levels. This glass, called *Plexite* is installed on the Martin flying boats built for Pan-American Airways' trans-oceanic service. In the manufacture of this product, a film made of a composition called Plexigum and having the resiliency of rubber is applied in liquid form to the glass. As this hardens, it forms a flexible binder for the two sheets of glass.

Features claimed for *Plexite* are its non-blotching and non-coloring characteristics; the elimination of the necessity of edge sealing; moisture resisting qualities; light weight; and ease of fabrication.

Personalities

By Caldwell

● Major General Oscar Westover, Chief of the Air Corps, was born in West Bay City, Michigan, July 23, 1883. After graduation from High School he entered the Army, and served for a brief period as an enlisted man in the Engineers. In 1902 he received an appointment to the Military Academy, from which he was graduated in 1906 with a commission at 2nd Lieutenant in the Infantry.

He served in that grade for five years, as First Lieutenant for another five years, and as Captain for another year. In September, 1917, he was transferred to the Signal Corps with the temporary rank of Major, after having served at the U. S. Military Academy as Assistant Professor of Drawing. In March, 1918, he was placed in charge of the Signal Office at the Port of Embarkation at Hoboken, N. J., where it was his duty to wave good-bye to the troops as they set sail for France.

In March, 1918, Major Westover was placed in charge of the Signal Corps Storage Department and Supply Depots, and in June he was put in charge of the Storage and Traffic Department, Bureau of Aircraft Production. He was promoted to Lieutenant-Colonel, Air Service, Aug. 14, 1918.

From Nov. 19, 1918, to June 30 of the following year Lieut.-Colonel Westover was Assistant Executive, Bureau of Aircraft Production, Washington, and then was in Office, Director of Air Service, during which time he received emergency promotion to Colonel, Air Service, May 24, 1919.

Maj. Gen. Oscar Westover

From July, 1919, to October, 1920, Colonel Westover served as Executive, Air Corps, and Chairman of the U. S. Claims Board. During that tour of duty he relinquished the wartime rank of Colonel, Air Service, and reverted to his regular Army status of Major in the Aviation Section of the Signal Corps on July 1, 1920, and on Aug. 9, in the newly organized Regular Army Air Service.

In 1921 he attended the Balloon School at Ross Field, California, receiving in turn the rating of Balloon Observer and Airship Pilot. He was winner in the National Elimination Free Balloon Race at Milwaukee in June, 1922, and as a result was the Army entrant in the International Balloon Race at Geneva, Switzerland, in August.

He was made Director of Air Corps production in Washington in 1922, and in 1924 he graduated from the one-year course at the Advanced Flying School at Kelly Field where he received the rating of Airplane Pilot, and some time later was rated as Aerial Observer. General Westover is one of the few officers to hold all of the various flying ratings in both lighter-than-air and heavier-than-air—a background which contributes greatly toward his being one of the best balanced officers in the Air Corps.

In 1924 Major Westover was Executive Officer at Langley Field, Virginia, later in the year becoming the Commanding Officer of that post, and the Commandant of the Air Corps Tactical School which was then located there. After two years in this post he entered the Tactical School as student, graduating in 1927. His next school tour was at the Command and General Staff School at Fort Leavenworth, Kansas, where the chief problem confronting the Air Officer is temporarily to curb his enthusiasm for aviation and to concentrate on a study of the Ground Army Organization. Major Westover graduated in 1928, completely packed with information, and so was retained as a member of the faculty there.

In January, 1930, he received his promotion to Lieutenant-Colonel and two years later, January, 1932, his appointment as Assistant Chief of the Air Corps with the rank of Brigadier General, to succeed Major General B. D. Foulois, who had vacated that position to assume his duties as Chief of the Air Corps. Upon the retirement of General Foulois in December, Brigadier General Westover succeeded him as Chief of the Air Corps, with the rank of Major General.

In addition to the four aeronautical ratings that he holds, General Westover was awarded the Distinguished Service Medal for meritorious wartime service. It has been his good fortune to rise to the highest post in the Air Corps without ever having had an enemy shoot at him in wartime. Now, however, if his experience in office is to be anything like that of his immediate predecessor, he will find some one shooting at him constantly. After a brief but interesting chat with the General in his office recently, I have come to the conclusion that the shots will merely bounce off. They will not worry him very much, for he is not the worrying kind.

General Westover is a man short of stature but solidly built, of unusually clean-cut and straightforward appearance. The outstanding impression I got of him is that he is a strong and forceful character. His handclasp is unusually firm; he shakes hands as though he meant it. He speaks quietly, using few words, but every word expressing clearly what he wishes to say. He is quick to express himself upon any point on which he is not in agreement with an interviewer, and to express himself briefly and forcefully. The General and I do not agree about the need for a separate Department of Air. His own viewpoint is that the Air Corps is a part of the Army, and that he is an Army officer. Under existing conditions he is certainly on firm professional ground when he takes that stand. I respect his viewpoint, though it surely is not my own. Of one thing I am certain. General Westover's administration of the Air Corps will be efficient and forceful; when he wants something he will go after it. And it is my belief that he will get it. I have seldom met a man who, on very brief acquaintance, so favorably impressed me as a strong and determined character.

I have heard from several sources that General Westover is very conservative. In the Air Corps we have so many rabid enthusiasts for this or that doctrine that perhaps it's fortunate that we have someone like the General to balance the whole. I mentioned my own confusion, when trying recently to write an article on pursuit and bombardment, due to the conflicting opinions I received from several of my friends in the Air Corps. The General very kindly offered to read the article before publication and to give me the official viewpoint of the Chief of Air Corps. I shall have to watch out, or the General will turn me into a conservative.

General Westover's experience, like that of many of our good aviators, includes it's ups and downs. He knows what it is to turn an airplane over on its back, and what it feels like to knock the landing gear off of a plane; and yet he has a very good flying record and is considered a good pilot. He has satisfactorily completed a course in instrument flying, which should be helpful to him in Washington, where so many people are practically flying blind all the time. Many a day, after finding it necessary to stay in his office from morning until night, he has followed it by going out to Bolling Field and getting some good practice at night flying. It is his habit to be in his office at work an hour before the whistle blows; and one can see his light after closing hours. Aero Digest wishes him every success during his tour of duty as Chief of the Air Corps.

● The new treasurer of the National Aeronautic Association is Benjamin King, well-known sportsman pilot and cave owner of the Shenandoah Valley. His experience with caves should help him when he flounders about in the cavernous financial depths of the N.A.A., seeking dollars and possibly finding only dimes.

Ben discovered several years ago that people would pay money to go down into caves. He hit on the idea by counting the number of folk who would stand for hours watching a steam shovel dig a hole. So as he and his associates owned a large hole in the Shenandoah Valley called Virginia Caverns, he put a ticket booth at the top end of it and charged admission. People who missed their steam shovel gazing during the depression went and paid money to gaze at Ben's cavern. Ben took the money and organized Tennessee Air Transport Co. in 1927, which he sold out in 1928 to Interstate Airlines.

Ben took his first flying lesson in 1916 with Silas Christofferson, while he was doing civil engineering in California. He couldn't afford very many lessons at $75 each, so he never finished the course. He joined the Air Service of the U. S. Army in May, 1917, and was assigned to the Aeronautical School of the University of California at Berkeley for a time, but was reassigned to aircraft production. He did very little flying until after the war, when he took occasional lessons.

After the war he returned to engineering and contracting, also represented New York financial houses in Central America, and got married in 1921. He is still a consulting engineer for several municipalities in Virginia, but finds time to do a great deal of flying, usually in an Aeronca.

He won a prize in the Liberty magazine Treasure Hunt of 1933, a combination of search and speed trial. During 1935 Ben King set six world records in an Aeronca. At Miami, as a feature of the Air Maneuvers there, he flew 70.48 miles an hour over a 500-kilometer course, creating an original record for seaplanes weighing less than 551 pounds. On the same day, Dec. 11, he flew the same little Aeronca over a 100-kilometer course at 80.93 m.p.h., breaking the record of 72.29 m.p.h. established five years ago by Pilot Vercruyse of France.

On June 16, 1935, with two-place Aeronca seaplane, Dan Brim co-pilot, he flew 185.4 miles, from North Beach to the Severn River, in 3 hours 25 minutes, establishing international and national records for light seaplanes of the 3rd. Category.

On June 25, with an Aeronca C2 seaplane converted to single-seater, which placed it under the 2nd. Category, Ben established an international and national record in that Category. The flight was from Port Washington to Anacostia, 221.2 miles in 3 hours 25 minutes, against a head wind of about 8 miles an hour. On Sept. 24 he broke an international record for altitude in 4th. Category light seaplanes, going up to 15,081 feet. The previous record, held by France and standing since 1930, was 11,354 feet. Ben tells me that the Aeronca engine was still revving normally and the ship was still climbing uniformly, as indicated by the official barograph tracing, when he had to start down without knowing how much higher the ship would go as he was flying without oxygen and began to experience discomfort.

In that same ship on Sept. 26 he established an international and national record for light seaplanes of the 4th. Category (weight empty less than 551 pounds) for airline distance. He flew from the Naval Air Station at Anacostia to Croton-on-Hudson, 230.31 miles in 2 hours 40 minutes, using only 8 gals. of fuel.

In these airline distance records Ben has never tried to get the maximum performance out of the ship. He only wants to show to other sportsmen pilots that with little ships of this type, comfortable and economical transportation between cities is available, both up and down wind. He takes off with a practical load and lands where he wants to, rather than load up to the limit and go as far as the ship would go. I believe that it will easily be possible for him to beat his own distance and altitude records whenever he finds time to try it. He is doing a fine job of demonstrating the utility of these small ships for the private owner, and of bringing more international air records to the United States.

Years ago Ben King was a student of banking, and was at one time a National Bank Examiner in the New York area. He used to look the bankers over to see if they should continue operating in this area or move to Atlanta. This experience is going to come in handy when he wrestles with the N.A.A.'s financial perplexities, which have already started to plague him. I had lunch with him recently in Washington, and he said that he had piled up a few more distance records running around trying to to find where the books were hidden by the former treasurer.

Ben King

* * *

I ran across my old friend Waldo Waterman in Washington. He had been hanging around there so long with the Bureau of Air Commerce and that little plane of his that one of the local civic groups mistook him for a statue, and hung a wreath on him. When I discovered Waldo he was moaning gently in the office of Bill Enyart, who is the official Wailing Wall of Washington. A gentle, kindly, sympathetic chap, Bill is a natural and practically helpless repository of all the griefs that aviation people carry to Washington. Sometimes when I have found life rather hopeless, I have dropped in on Bill for comfort and encouragement.

The day that Waldo and I sat in with Bill was not an especially auspicious one for those seeking encouragement. In the first place, Bill had just got back from the sad duty of burying a friend who had found life worthless under a Democratic regime, and had therefore sat moodily in his garage with the engine of his car running, until all was over. This put Bill in just the right mood to talk to Waldo, who discoursed at some length on the trials and tribulations of an airplane manufacturer.

Ben King getting ready to make a few more seaplane records

In the second place, a thought that I believe originated with Jimmy Doolittle has resulted in swamping poor Bill entirely. Jimmy got the idea that it would be a good notion for the N.A.A. to send out a questionnaire asking all and sundry what they thought should be done to help aviation. Now, you only have to ask people what they think is the matter with something, and you will receive from each one a ten-page letter giving the details. Bill has now begun to receive these letters, and if they were bound in volumes they would fill a five-foot shelf. He has his desk piled up with these letters by the hundreds, by the thousands. At times he will pick up one, read it, and start moaning softly to himself. He is supposed to tabulate the letters, boil them down, and see what, if anything, can be done.

I once sent out just such a questionnaire myself, and I can say now that probably nothing can be done. I have come to the conclusion that aviation will progress, in spite of all of us, and in spite of all our ideas. If we could ever manage to think alike on even a few aeronautical topics, we might do a little better. But I doubt it, really. One of the chief charms of this business is the variety of ideas in it which makes it a continuous vaudeville performance.

THE AIR SERVICES

VN2D8 Wins Trophy

The Herbert Schiff Memorial Trophy has been awarded to Lieut. Phil L. Haynes, U. S. Navy, Commander of Training Squadron Two, stationed at the Naval Air Station, Pensacola, Florida. This squadron had the best record for safe flying of 61 naval aviation squadrons competing for the trophy.

In qualifying for this trophy, Training Squadron Two (VN2D8) flew a total of 18,699.75 hours from July 1, 1934 to June 30, 1935.

Scouting Squadron One (VS-1B) attached to the U.S.S. *Ranger* and commanded by Lieut. Comdr. M. I. Schoeffel, U.S.N., now on duty in the Office of Chief of Naval Operations, stood second with a total of approximately 6,100 hours of flying.

Scouting Squadron Two (VS-2B) attached to the U.S.S. *Saratoga* and commanded by Lieut. Comdr. Felix Stump, U.S.N., was third.

The trophy is awarded annually on the basis of the greatest number of hours flown, with maximum safety.

Bomber Construction

Construction of thirteen bombers for the U. S. Army Air Corps will be undertaken immediately by the Boeing Aircraft Company of Seattle, following receipt of an order from the government.

The planes will be identical with the Boeing 299 four-engined bomber which was brought out last July and which subsequently attracted attention in flying the 2100 miles from Seattle to Dayton, Ohio, without a stop, at an average speed of more than 232 m.p.h. Like the 299, they will have a wing spread of 105 ft., length of approximately 70 ft., and a gross weight of about 15 tons. Power, however, will be supplied by four Wright Cyclone Series G engines, instead of the P. & W. engines used in the 299 when it made its record flight. Features will include the latest in armament installations, the most modern flight and engine instruments, two-way radio telephone equipment, a radio homing device, retractable landing gear and tail wheel and air brakes.

On their completion, the bombers will constitute what is declared will be the finest squadron of its kind in the world. Not only will they be America's largest land plane, but they will represent a great advance in load-carrying capacity at high speeds.

According to Boeing officials, the first plane will be delivered within ten months and the order will be completed in approximately eighteen months. All planes will be flight delivered from the Boeing plant.

Dallas Aids Hensley

City Manager Hal Moseley of Dallas has announced that the city will sponsor the Hensley Field, army reserve field, airport improvement and construction project by contributing the sponsor's costs for supervision amounting to $2,700. Approval of the grant for work has already been received from the Bureau of Air Commerce at Washington, but this indicates that the project is satisfactory from the viewpoint of civil aeronautics, Capt. Bernard Thompson, Hensley Field commander, announced. Approval of the allocation will be made soon. The project includes the completion of runways, extension of the apron around the hangar and the construction of an addition to the hangar to double its capacity. The erection of several administrative buildings is also planned.

Coast Guard Base

Floyd Bennett Field, municipal airport of New York, will become the principal base of the U. S. Coast Guard in that section of the Atlantic Coast. Eight planes are to be based at the field, part of which has been conditionally leased on a 50-year term.

An area 650×650 ft. near the present seaplane ramp is for Coast Guard use under present plans which also call for government construction of a hangar, buildings, repair shops and additional ramps.

Command Changes

Commander Alfred E. Montgomery has been detached from command of the Naval Air Station, Anacostia, D. C., and ordered to service on the staff of the Commander Aircraft, Battle Force, Vice Admiral Henry V. Butler. Lieut. Comdr. Knefler McGinnis, executive officer of Anacostia, will act as commanding officer until late spring. Commander Montgomery has been in command of the station since July, 1934. Prior to that he was attached to the Office of the Chief of Naval Operations for a year.

* * *

Capt. Russell H. Cooper, unit instructor of the 315th Observation Squadron, U.S.A.C.R. stationed at Hensley Field, Dallas, for the past six years, has been transferred to Patterson Field, Ohio. Capt. Russell came to Hensley from San Antonio.

Wasp-powered Curtiss SOC-1, 135 of which have been ordered for the U. S. Navy

TC-14 For Army

The TC-14, a coastal patrol airship, has been accepted for the U. S. Army Air Corps after test flights by Lieut.-Col. Frank M. Kennedy, commanding officer of Scott Field, Belleville, Ill. The craft is similar to the TC-13, now stationed at the Sunnyvale, Calif., lighter-than-air base recently taken over by the Army from the Navy.

Powered with three 300 h.p. engines, two mounted in outboard gondolas and the third in the tail of the control car, the TC-14 is capable of a maxmium speed of more than 85 m.p.h. It has a helium capacity of 360,000 cu. ft. and is 237 ft. long and 57 ft. in diameter.

With its full gasoline capacity of 1300 gallons, the craft is capable of cruising for 72 hours. It has accommodations for cooking and sleeping for its crew of eight.

The sub-cloud car in which an observer can be lowered 3000 feet below the craft, is also included in the equipment.

Airbase Site Scouted

A board of naval officers appointed by the Commandant of the 12th Naval District at San Francisco, recently inspected an area including and adjacent to Point San Mateo, San Francisco Bay, with a view to determining the suitability of that site for possible use as a naval air base. The development of a naval air base on San Francisco Bay is urgent. The Navy Department prefers to locate such air base at Alameda, but as yet the voters of the city have not authorized the city government to transfer to the federal government an essential area of the municipal land. In case the city of Alameda should fail to authorize the proposed transfer of land, the Navy Department would have to decide upon another location and, therefore, is continuing to examine other possible sites.

Services Exchange Fields

Joint recommendations of the Secretaries of War and Navy for interchange of several existing Army and Navy Fields were approved by President Roosevelt. As a result Rockwell Field has become a Navy base, and Sunnyvale an Army field.

Other changes call for the Army to turn over to the Navy that part of Ford Island, Pearl Harbor, once occupied by the Army, as soon as other facilities for the latter can be obtained; that metes and bounds acceptable to the Army and Navy of that part of the Anacostia Air Field now occupied and used jointly by both, be established and that the station so defined be turned over to the Navy.

Down She Comes

Rough water, smooth water, fair weather or foul — the Corsair has taken them all in its stride during seventeen years of distinguished service with the U. S. Fleet.

Chance Vought Aircraft

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PRIVATE FLYING AND CLUB NEWS

Air Tour

Through the cooperation of pilots in a dozen southern cities a new type of air tour will leave Atlanta, Ga., early this month. Flying fifteen or more Taylor Cubs the group will participate in a sporting and vacation tour for owners of this type of airplane. Economy and efficiency will be featured. Exhibitions will be made in the cities visited and demonstrations will show features of the Taylor plane. Tentative itinerary includes Atlanta, Savannah, Jacksonville, Tallahassee, Pensacola, Montgomery, Tuscaloosa, Mobile, Chattanooga, and New Orleans. Other cities are being added to the list as plans for the tour near completion.

News of Clubs

A group of undergraduates of Southern Methodist University, Dallas, have organized a student club, to give the university students an opportunity to learn to fly at minimum cost. Operations are conducted at Hampton Airport, in Oak Cliff, Dallas suburb. Steve Henry is president.

* * *

Pegasus Flying Club, with headquarters at Hotel Lexington, New York, announces a course of lectures to be given Friday evenings, beginning January 31, by Charles Wenzel, Jr. The course will stress meterorology, navigation and the mechanics of flying. Now entering its third year, the club consists of a group of amateur sportsmen and sportswomen interested in flying. It owns an Arrow Sport, which is housed at Floyd Bennett Field. Officers include Leon Sachs, president; and Ruth Bailey, vice-president and secretary.

* * *

The New York Flying Squadron is composed of 15 members who are trying to give support to the advancement and support of aviation. Headed by Jack D. Gasparro, its founder, the group plans to purchase a plane this year.

* * *

The Aero Club of Parks Air College started a drive for new members with an open meeting at which Major Ray Wassel, manager of the Curtiss-Steinberg Airport, was the speaker of the evening. Twenty-eight guests were invited to join the club.

Students ot the Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal have organized the Curtiss-Wright Tech Recreational Association for the purpose of furthering their social and sports activities. Tom G. Short is president; Gordon Sheridan, vice-president; Charles Belda, secretary; Bert Prestwich, treasurer; and John Stevenson, chairman of the athletic committee.

* * *

Tuesday evenings have been designated as aviation nights by the Army and Navy Club of Chicago. The first meeting was addressed by Howard M. Groth of United Air Lines traffic department.

* * *

David Williams of Charleston, W. Va., has established a sportsman flying club at Wertz Field. H. H. Burton, Harry Belt, M. A. Shaeffer and Cole Johnson are charter members. Operations are to be carried on in an Aeronca for instruction but early this summer another plane is to be secured for cross-country flights.

Large Aerial Survey

The flying part of the aerial survey of the 22,000,000-acre area in the watershed of Rio Grande of Central New Mexico, largest aerial survey ever attempted in this country, has been completed, according to Leon T. Eliel, vice-president of Fairchild Aerial Surveys of Los Angeles, Calif., which made the survey for the Department of Agriculture's Soil Conservation Service. This was speeded up and made easier than could otherwise have been possible by the Fairchild tandem 10-lens aerial camera, which was developed by the Fairchild Aerial Camera Co., and Fairchild Aerial Surveys to facilitate this undertaking.

Flying was completed between the middle of July and December 1, and approximately 400 photographs were taken, with the actual mapping being done with a smaller camera, with which approximately 9000 photographs were secured. One of the composite photographs secured with the 10-lens camera covered 330 square miles.

Celebration

The cities of Tampa and St. Petersburg, Fla., are jointly commemorating the establishment of the world's first scheduled commercial airline which was inaugurated in the spring of 1914 between these terminals. To celebrate this event the civic bodies of both cities have arranged an aviation program to be held in St. Petersburg on Feb. 1, and in Tampa on Feb. 2.

ACTIVITIES AT THE SCHOOLS

Two Schools Accredited

Recognition by California state educational authorities of the value of commercial aeronautical training, has been established by a recent affiliation between the Ryan School of Aeronautics, San Diego, and State College, located in the same city. As a result of this plan, a group of approximately thirty students in the State Junior College will be selected immediately for vocational training. The course will extend through a two year college period and will be open only to regularly matriculated students in State College academic departments. Instruction which State College students will receive at the Ryan School will include a complete transport ground course in addition to mechanical training on airplanes and engines, sheet metal work, aircraft welding, radio and airplane drafting.

* * *

The Lincoln Airplane & Flying School, Lincoln, Neb., has received government approval of a mechanic's course. The school has for a number of years operated as a transport government approved flying school, and is one of the oldest of its kind in the country. There are now approximately 200 students enrolled.

School Activities

Ryan School of Aeronautics staged an air show at Lindbergh Field recently to demonstrate to the public the fact that the handling of a plane in normal maneuvers was an accomplishment possible with only a limited amount of flight training. The program consisted of four main events including formation flying, spot landings, precision spins, and bomb dropping. Winners were Walter McIntyre, Cliff Hornung, Alex Hyde, and John Milner. Following the student contests in which 16 students participated, John Fornasero, chief flight instructor, flew a 125-h.p. Ryan S-T in a series of acrobatics.

* * *

The student body of the Spartan School of Aeronautics recently made a mass cross-country flight to Gainesville, Tex., where they were entertained at a dinner and dance. Inclement weather cancelled proposed trips to Paris and Dallas, Texas, and to Oklahoma City.

* * *

Lincoln Airplane & Flying School is giving a one-year airplane and engine mechanics course, government approved.

Students of the Boeing School of Aeronautics attending a class in the instrument laboratory

"Solo"

Have you ever pushed in the throttle—with the seat in front of you empty for the first time—and, gaining speed, gently lift your ship into the sky? With the field slipping away beneath, you bring her around in a wide shallow turn, skirting the field, coming around in another turn, and throttling back, gradually losing altitude, with your instructor standing on the ground ahead—you bring her down to a three point landing.

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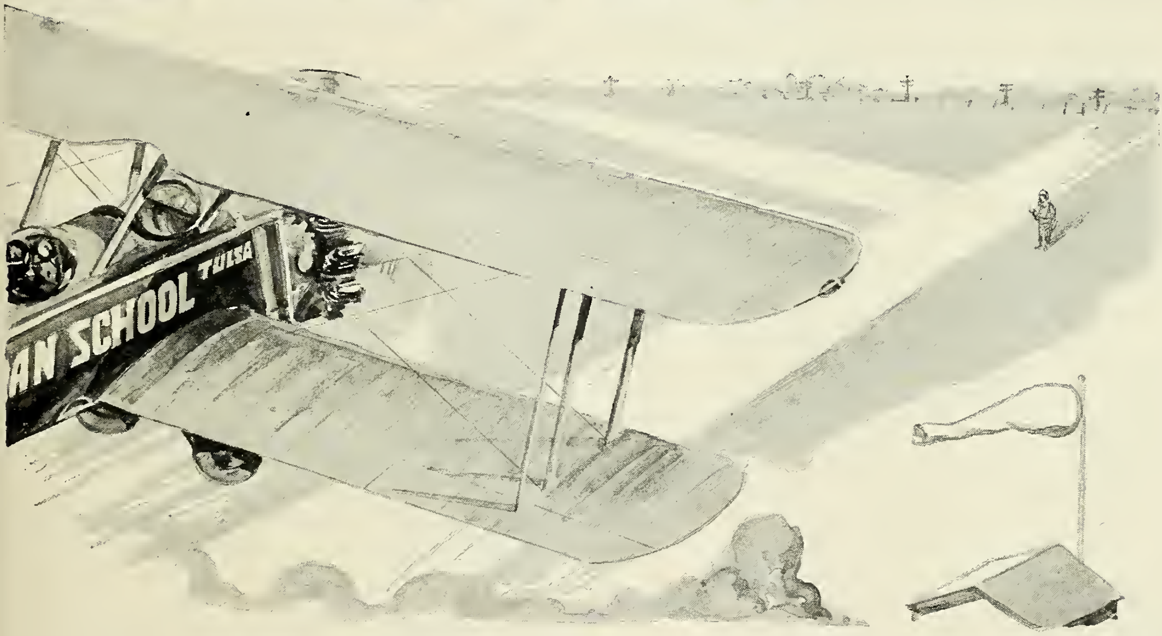

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AIRLINES AND AIR TRAVEL

●

Express Unification

Twenty-four airlines have joined in a unified air express system which, effective February 1, will provide service to shippers on a more expeditious and economical scale than had been possible under conditions which previously existed when two air express agencies handled the business.

Through contracts signed by 20 of the 23 domestic airlines in the United States and Pan American Airways, with the Railway Express Agency, direct air express service, with door-to-door pick-up and delivery service, will be provided to 215 cities in the United States and Canada and to 32 foreign countries through the Pan American Airways System. In addition, through the use of combination air-rail service, the 23,000 Railway Express offices become air express stations.

The companies included in the coordinated set-up are: American Airlines, Boston-Maine Airways, Bowen Air Lines, Braniff Airways, Central Airlines, Central Vermont Airways, Chicago & Southern Air Lines, Columbia Airlines, Delta Air Lines, Eastern Air Lines, Hanford Airlines, National Airlines System, National Parks Airways, Northwest Airlines, Pennsylvania Airlines, United Air Lines, Varney Air Transport, Watertown Airways, Western Air Express Corp., and Wyoming Air Service. Only TWA, Wedell-Williams and Wilmington-Catalina Airline are missing and according to L. O. Head, president of Railway Express, efforts are being made to have these companies join the new combine.

Mr. Head characterized the improved, expanded air express service as one of the most progressive developments in express transportation since the original consolidation of the various express services of the country nearly two decades ago. The Express Agency first entered the air express field in 1927.

Development of air express traffic has been particularly rapid during the past three years, with poundage more than doubling annually until now it has become a regularly used transportation service by thousands of industrial concerns. Outstanding among these are the news and advertising fields, automotive industries, fashion goods and allied industries, motion picture companies, drug manufacturers and machinery makers.

Schedule Revisions

December schedules on United Air Lines showed the company maintaining in excess of 1,000,000 miles of scheduled flying, a greater amount of winter operations than the company has scheduled any season previously. Three coast-to-coast flights daily were supplemented by an additional schedule between New York and Salt Lake, and commuter service between Los Angeles and San Francisco and Chicago and New York was continued. A new 3:25 p.m. departure from Philadelphia providing overnight service to Pacific Coast cities was inaugurated and a new 3:15 p.m. departure was fixed at Vancouver.

Reequipment

An expenditure of almost $100,000 for modernizing and purchasing flying equipment will be made in the near future by National Parks Airways.

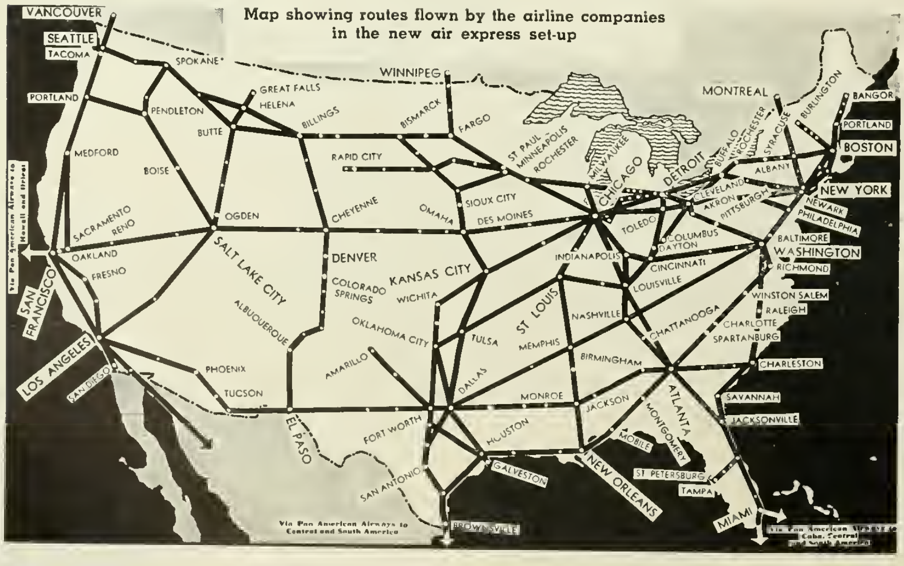
Improvements which will be made in the Boeing 247 transport airplanes will include the installation of new type engines, three-bladed propellers with automatic pitch controls, and automatic carburetors. In addition, cabins will be re-insulated to reduce noise and vibration, cabin chairs will be re-upholstered and the cabin in general redecorated.

The modernized planes will cruise at 180 m.p.h. with a maximum speed of 200 m.p.h., reducing flying time from Salt Lake City to Great Falls, Mont., to approximately 3½ hours, representing a ten percent reduction in flying time under present schedules.

* * *

Lockheed Electras which will make the run between Portland, Me., and Boston in 35 minutes will be placed on the line of Boston-Maine Airways between Boston, Portland, Augusta, Waterville, and Bangor, if contemplated plans for airport improvements are carried through.

Airports at Augusta and Waterville are already sufficiently large to take these ships; a third runway at Portland will make that port satisfactory; and improvements are promised at Bangor.


Map showing routes flown by the airline companies in the new air express set-up

Transport Head

With the completion of the organization of the Air Transport Association of America, Col. Edgar S. Gorrell was named president, and Fowler W. Barker, secretary and treasurer.

Purpose of the new organization, whose membership includes every scheduled airline company in the United States, is aimed at coordination of schedules, credits, advertising, engineering data, and buying power. Its functions will similate those of the North Atlantic Steamship Conference and its president will have power approximating that of Will Hays of the movies and Judge K. M. Landis of baseball.

The operators recently withdrew from the Aeronautical Chamber of Commerce in an endeavor to have an independent organization to solve the difficulties peculiar to air transport.

More Cooperation

The airplane of the future, with a carrying capacity of forty to fifty passengers, and several hundred pounds of payload was the subject of formal discussions in Chicago between executives of five of the leading airlines.

Plans are being discussed so that the lines could agree on the choice of a transport plane suitable for all, and combine their purchasing power to obtain these planes on an economical basis. Cost of experimental work would be pro-rated between the companies.

The type finally selected is expected to be a four-engined transport capable of long range operation with heavy payload. It is estimated that two years would be required to provide the companies in the pool with the new equipment. The conference was the culmination of a year's effort by executives, engineers, technical and traffic experts of the several companies interested to formulate universal specifications adaptable to all lines. These plans will be submitted to manufacturers for building experimental planes of the type desired. If the experimental planes prove satisfactory after tests under actual transport conditions, the orders for the combined fleets will be placed immediately.

Officials at the conference were C. R. Smith, president, American Airlines; Capt. E. V. Rickenbacker, general manager, Eastern Air Lines; Frank Gledhill of Pan American Airways; Jack Frye, president, TWA, and W. A. Patterson, president, United Air Lines.

Among the manufacturers interested in the project are Douglas Aircraft Co., Sikorsky Aircraft Co., Curtiss-Wright Airplane Co., and Boeing Airplane Co.

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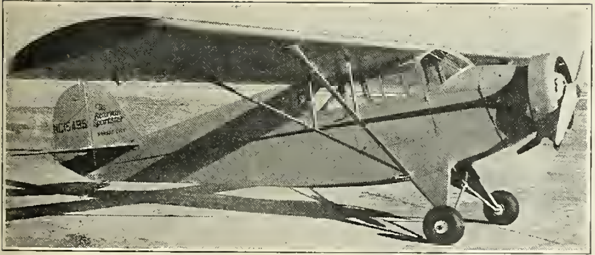

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AT THE AIRPORTS

New Airports

An appropriation of $105,000 for a new municipal airport at Emporium, Pa., has been granted by WPA. Work will consist of enlarging the field, erecting a hangar, building two hard-surfaced runways, installing fences, and boundary and other lights.

* * *

A new airport costing approximately $20,000 is being constructed at Iuka, Miss. A site containing 200 acres has been purchased by the city.

* * *

A $3,000,000 state airport project, which will provide also a new seaplane base on Lake Washington in Seattle and an airport six miles south of Everett on Puget Sounds, as well as a 5000 ft. runway at the municipal airport of Seattle, has been proposed by T. H. Bowden, assistant state WPA administrator of Washington. Capt. Edward Whitehead, district adviser of the Bureau of Air Commerce, has approved this project.

Improvements

Recommendations concerning the proposed rebuilding of the Ogden (Utah) airport on a new site have been given to the city commission, according to J. A. Howell, chairman of the aviation committee. It will cost approximately $150,000, of which the city would be required to furnish $25,000, plus the cost of about 260 acres of land to improve the airport on a new site. Ogden expects to materially increase aviation activities by the construction.

* * *

Plans are being made for extension of the Salt Lake airport to provide for any type of land plane. Officials have sketched necessary improvements and laid plans for their immediate adoption, as follows: concrete aprons at the hangars, rebuilding of city hangar, hardsurfacing and extending the runways to a length of 4840 ft., installation of flush type boundary markers, enlargement of administration building, and beautification of grounds.

The accompanying diagram shows the proposed improvements for the airport. Dotted lines indicate proposed extensions of land and runways and two taxi strips from the north-south runway. At present the NW-SE runway is 100 ft. in width. For blind landings on this runway, two radio compass stations are proposed, one 1500 feet from end of runway and the other two miles in the same line. Numbers show the present buildings: 1: City hangar. 2: United Air Lines hangar. 3: U. S. Army hangar. 4: Administration building. 5: Western Air Express hangar. 6: Thompson Flying Service hangar. 7: Storage hangar. 8: National Parks Airways hangar. Diagonal lines indicate dirt areas surrounding buildings.

* * *

Improvements to be made at the Arkansas Polytechnic College airport at Russellville, will include a new hangar for which an allotment of $16,000 in WPA funds has been made.

* * *

The proposed improvement to the Elko, Nev., airport is expected to begin soon at a cost of $20,000 under a WPA set-up. An additional appropriation is planned to change the course of the north-south runway to the west for a considerable distance. Most of the work will be graveling.

* * *

The Bryce Canyon airport, in southern Utah, may be improved at a cost of $20,000. Western Air Express has assured the Salt Lake City Chamber of Commerce that scheduled stops will be made there in the summer if adequate facilities are provided.

* * *

The drainage system at the Omaha, Neb., municipal airport is now undergoing reconstruction under a $174,000 appropriation made thru the WPA. Approximately 600 men are expected to be at work there this spring under an expected total expenditure of $600,000.

Thirty-eight airports in Utah are to be improved, including those at Salt Lake City, Provo, Richfield and others. The plan is to spend $235,000 of federal money on the airports.

Efforts are being made to improve Salt Lake City's municipal airport and the Department of Commerce has approved an $82,000 airport project here.

* * *

City officials, working with WPA heads, have discussed plans for the construction of a hangar at the municipal airport in Marshall, Texas. The field is located east of the city. City Manager H. J. Graeser has announced that the project is pending at present.

* * *

Texas airport improvement and construction projects which have been approved technically and are satisfactory to the Bureau of Air Commerce include Kell Field, Wichita, $64,459. San Antonio, municipal airport, $77,040; Wink, Texas, $3,293, and municipal airport, Texarkana, $37,746. The Kell Field improvement includes extending, paving, shaping and blading runways, paving taxi strips, hangar aprons and floors, lighting system, hangar and shop repairs, water system and administration building, cafe and residence, plumbing old water tower, moving old water tank and concrete servicing island to new locations and sodding and constructing brick columns at entrance of the administration building.

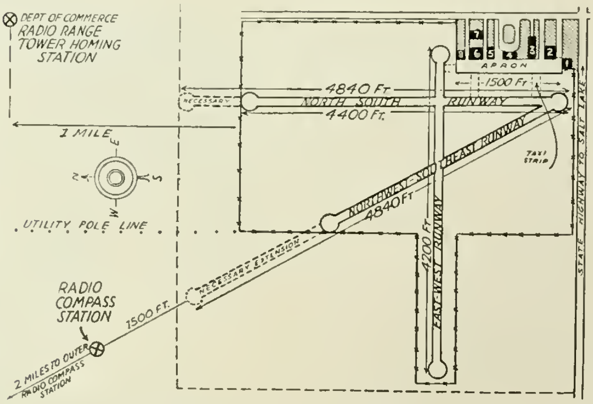

Diagram showing proposed improvements at Salt Lake airport

2,369 Airports

There were 2,369 airports and landing fields in the United States on January 1, 1936, according to the Bureau of Air Commerce, Department of Commerce. Of these, 698 were partially or fully lighted for night use.

The total included 739 municipal and 494 commercial airports, 291 Department of Commerce intermediate landing fields, 631 auxiliary fields, 63 Army airdromes, 26 Naval air stations, and 125 miscellaneous government, private and state airports and landing fields. On January 1, 1935, there were 2,297 airports and landing fields.

Six states had more than 100 airports and landing fields each on January 1, 1936, including California with 192; Texas, 134; Michigan, 117; Pennsylvania, 117; Florida, 107 and Ohio, 103. Texas led in the number of municipal fields with 56 and in intermediate fields with 25. Pennsylvania had the greatest number of commercial fields, 68.

New Companies

Mountain State Air Transport Co., has been established at Wertz Field, Charleston, W. Va., as its headquarters. Lieut. Hubert Stark has been elected president and chief pilot; Herchul McCown, vice-president and John Lanchester, assistant pilot. For the present student instruction and sight-seeing flights will be conducted in a Great Lakes Trainer and a Stinson Reliant. Early this spring a low-wing Aeronca is to be purchased.

Traffic

Breaking all yearly records with a jump of 43,000, airline traffic at the Cleveland, Ohio, airport in 1935 totaled 145,666 passengers, according to Maj. John Berry, airport manager. Airline passenger total in 1934 was 102,050. There were 24,789 arrivals and departures by transports, an increase of 4,000 over 1934. Including the 6,559 privately owned or military planes that visited the field and the 6,196 passengers that rode in them, the total of traffic handled at the field in 1935 rose to 151,862 passengers, and 31,348 planes.

* * *

A 9 percent increase in passenger traffic at the Chicago municipal airport was reported by Oscar E. Hewitt, Chicago commissioner of public works.

There were 191,000 passengers on scheduled flights, and 13,500 arrivals and departures of scheduled transport planes. Including all other flights of military, sight seeing planes and chartered flights, the total reached 29,000 arrivals and departures.

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THE INDUSTRY IN GENERAL

Aircraft Show

The National Pacific Aircraft and Boat Show, sponsored by California Air Industries, opened February 1 for a nine-day run. Held in the new Pan-Pacific Auditorium in Los Angeles, it shows some of the latest developments in aircraft, engines, accessories and general supplies.

Among the exhibits is the new American Airlines Douglas Sleeper Transport standing in the center of the building near the band stand. In the three adjoining displays facing the center of the auditorium is a club model Electra and the Kinner and Northrup exhibits.

MacMillan Oil Co., is showing the Curtiss Robin *Ole Miss,* holder of the world's endurance record, and Col. Roscoe Turner's Wedell-Williams racer which held the trans-continental speed record. United Air Services, Ltd., has on exhibition Amelia Earhart Putnam's Lockheed *Vega* in which she set a number of records and also made her solo flight from Honolulu to Oakland. The American Gyro Co., has entered its twin-engined Gyro *Crusader* and it is expected that the new Menasco-powered Brown B3 high speed, two-place cabin touring plane will also be shown as well as the *Miss Los Angeles* one of Brown's special racing monoplanes.

The Ryan School of Aeronautics and Ryan Aeronautical Co., have a joint exhibit with a fully equipped Ryan S-T suspended over the booth and an uncovered model of the same type on display on the floor.

Other planes on display will include a Taylor Cub, Stinson, Waco, Beechcraft and several smaller models as well as the Link Trainer.

United Aircraft Corp., is exhibiting a 14-cylinder 2-row Pratt & Whitney Twin Wasp Junior, through the courtesy of the U. S. Navy, working cutaway models of the Series H Wasp; 14-cylinder Twin Wasp; and Hamilton Standard controllable pitch propeller; a Hamilton Standard 2-bladed and 3-bladed controllable pitch propeller; the new Hamilton Standard constant speed control; a model of the latest Vought Corsair, the SBU-1, a replica of the Vought Scout-Bombers which are now being delivered to the U. S. Navy; models of the Sikorsky S-42 and S-43, and pertinent and interesting photographs. Menasco Manufacturing Co., shows its new 250 h.p. Super Buccaneer.

Other engine exhibits show Wright, Kinner and Continental products. Parts, accessories and other equipment are being exhibited by Kollsman, American Airlines, Western Electric, Packard Electric, Shell and Standard Oil companies, Bendix Aviation Corporation, United Air Lines, Air Associates, Cleveland Pneumatic Tool Co., Berry Bros., RCA Manufacturing Co., General Tire and Rubber Co., Harris Thurston Co., Ohio Seamless Tube Co., Pacific Scientific Co., California Panel and Veneer Co., Nicholas-Beazley Airplane Co., Curtiss-Wright, Precision Bearings, Pacific Aircraft Sales, Charles Babb, Pacific Airmotive Corp., Thompson Products, Inc., Fairchild Aerial Survey, Goodyear Tire Co., Elastic Stop-Nut Corp., Inc.

In addition, Aero Digest and The Sportsman Pilot also have space at the show.

San Diego Air Fair

Following the appointment of Franklin K. Lane as aviation commissioner of the 1936 California Pacific International Exposition, interest of the aviation world is being centered upon San Diego.

Through contact with Washington officials and heads of aviation companies throughout the east, Mr. Lane is working as liaison man between them and exposition executives. A joint display by the five leading airlines, depicting air travel in its relation to the March of Transportation, is the immediate goal toward which Mr. Lane and exposition officials now are working as well as an attempt to have exhibitors at the present Los Angeles aircraft show also exhibit in San Diego.

Mass flights and aerial demonstrations of national defense last year were features of the exposition and again will be staged during the 1936 season, according to plans of naval officials.

Metals Exhibit

A technical exhibit of "Metals in Aviation" opened to the public on January 20, on the third floor of the International Building, Rockefeller Center, New York. Sponsored by Aero Digest, through the courtesy of Metal Products Exhibits, Inc., whose galleries contain permanent exhibits of metals as they are utilized in other industries, this display of modern aeronautical parts and complete units is both interesting and educational. Individual displays range in character from precision parts to wing sections, and present examples of the latest processes of metal fabrication, as well as the newest alloys developed especially for the aircraft industry.

The exhibit will continue for two months. Admission is free.

Companies participating in the exhibit include: Sikorsky Aircraft, Wyman Gordon Co., Champion Spark Plug Co., Aluminum Co. of America, S. K. F. Industries, Inc., United-Carr Fastener Co., Fleetwings, Inc., Arens Controls, Norma-Hoffmann Bearings Corp., Fafnir Bearing Co., Hamilton-Standard Propeller Co., Hartford Machine Screw Prod. Co., Climax-Molybdenum Co., Summerill Tubing Co., Dzus Fastener Co., Scintilla Magneto Co., Haynes-Stellite Co., Curtiss-Wright Airplane Co., Pratt & Whitney Aircraft, Solar Aircraft Co., Hill Aircraft Streamliners Co., Titeflex Metal Hose Co., Paramount Welded Aluminum Products Co., Edo Aircraft Co., American Brass Co., Hazard Wire Rope Co., Wright Aeronautical Corp., McLaughlin Aerial Surveys, Western Electric, Fairchild Camera, and Swift Lubricator Co.

Transportation Building at the San Diego Fair

Plant Expansion

Representing an investment of about $650,000, an expansion program comprising one of the largest hangars ever constructed and of unique type, large new production area and extensive additional engineering quarters, has been launched at the plant of the Douglas Aircraft Company, Inc. With this new expansion, the plant will represent a total investment of more than $1,000,000.

One unit is under way at the east side of the original plant, work just has been launched on the hangar at the east of this unit, and plans are being completed for a 300-ft. frontage unit to adjoin the plant at the west end.

Foundations are being poured at the rear of the site of the proposed new west end unit for a one-story receiving, stock and foundry building, 380 ft. long and 72 ft. wide.

The unit at the east side of the plant will be a one-story and mezzanine structure with a frontage of 200 ft. and depth of 300 ft.

Plans for the all-steel hangar call for ground dimensions of 285 frontage by 300 ft. in depth. The center of the arching roof will be 90 ft. above the ground.

The roof will be entirely supported by steel arches with interlacing trusses, making the structure one of the world's largest with such roof support.

Safer Flying

Miscellaneous aircraft operators flew more miles in the first half of 1935 than in any previous January-June period since 1931, and at the same time achieved a new safety record, according to the Bureau of Air Commerce, Department of Commerce. These operators flew 40,234,185 miles in the first half of 1935 and carried 556,332 passengers. The passenger total was slightly less than that for the first half of 1934.

The number of passenger fatalities during the period was 49—smaller than for any previous six-months period for which statistics are available. The miscellaneous operators flew 821,106 miles per passenger fatality, an advance of nearly 100 percent over the first half of 1934. The number of pilot fatalities was 67, lower than for any other six-months period except the first half of 1928, when there were only 65 pilot fatalities.

Parker Moves

Larger and more commodious quarters have been taken by Parker Appliance Co. at 17325 Euclid Ave., Cleveland. Production facilities have been increased and the organization enlarged to expedite service and expand products to meet demands.

(*Continued on following page*)

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SEE PAGE
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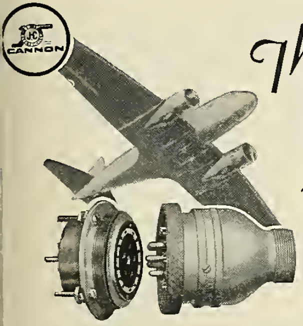

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CANNON PLUGS

6 WORLD'S RECORDS in 1935

Established in AERONCA Seaplanes

ALL MADE WITH THE STANDARD AERONCA ON PONTOONS

By BEN KING

TWICE during 1935 Ben King, sportsman pilot of Washington, D. C., and his Aeroncas put the United States in the lead over all nations in the number of international air records held.

The six world records for light seaplanes by which Mr. King and his Aeroncas brought supremacy to the United States are:

2nd Category— *(Single-seaters, weighing empty between 1,258 and 552 lbs.) Port Washington, Long Island, N. Y. to Anacostia, D. C., June 25. Airline distance 221.2 miles.*

3rd Category— *(Multi-seaters weighing empty less than 772 lbs.) New York to Maryland, June 16. Airline distance 185.4 miles.*

4th Category— *(Single-seaters, weighing empty less than 552 lbs.)*
Anacostia, D. C., Sept. 24. Altitude 15,738 feet.
Washington, D. C. to Croton Bay, N. Y., Sept. 26. Airline distance 230.314 miles.
Miami, Fla., Dec. 11, Speed for 62 miles, 80.931 m.p.h.
Miami, Fla., Dec. 11, Speed for 310 miles, 70.48 m.p.h.

THESE six records add further testimony to Aeronca leadership. For when a standard light land plane is given the added weight of pontoons and still breaks world records, it can't be "just another airplane."

At Miami, too, during the All-American Air Races, Karl Voelter, in a standard Aeronca land plane was OFFICIALLY TIMED at 92.27 m.p.h. from a standing start on a closed course. This, of course, equals at least 100 m.p.h. actual flying speed. ***Aeronca's advertised straight-away speed is 93 m.p.h.***

Aeronca leadership is based on achievement. Aeroncas in service far outnumber all other light planes. When equipped with Edo pontoons, the landplane becomes an ideal seaplane. Investigate and your choice, too, will be an Aeronca.

AERONAUTICAL CORPORATION OF AMERICA
Lunken Airport Cincinnati, Ohio

AERONCA RESEARCH AND IMPROVEMENT HAVE NEVER STOOD STILL

Recently-approved Fairchild "24" seaplane

(*Continued from preceding page*)

Seaplane Approval

Flight tests on the Warner powered Fairchild "24" seaplane conducted off the plant of the Edo Aircraft Corp., College Point, N. Y., resulted in the award of a seaplane A.T.C. at a gross weight of 2550 lbs. which, with a normal weight empty of 1703 lbs. leaves a useful load of 847 lbs. This may consist of 3 persons, 40 gals. fuel and 97 lbs. of baggage and extra installed equipment with a wooden propeller, or 3 persons, 40 gals. fuel and 64 lbs. of baggage with a Hamilton Standard propeller. Performance shows full load take-offs in a 4—5 mile wind were accomplished in 20 sec., while light load take-offs required 7 to 9 sec. Maximum speed at sea level was approximately 120 m.p.h. at 2150 r.p.m.

This ship is equipped with Edo model 44-2425 floats.

Sectional Flight Chart

The task for scanning the entire United States from the air, to make certain that charts for airmen correspond with what the airman actually will see when he flies over the territory represented, has been completed. This flight checking operation was undertaken in connection with the series of 87 sectional aeronautical charts which are being published by the Bureau of Air Commerce. The charts are compiled and printed for the Bureau by the Coast and Geodetic Survey.

Forty-eight of the charts now are in circulation. Preliminary drafts of others are being corrected in accordance with the findings of the flight checks.

14,805 Pilots

On January 1, 1936 114,805 pilots and 7,371 aircraft were listed as holding active licenses issued by the Department of Commerce according to the Bureau of Air Commerce. This represented an increase of about 1,000 in the number of pilots and a similar increase in aircraft since January 1, 1935, when there were 13,949 licensed pilots and 6,339 licensed aircraft.

Unlicensed aircraft were less numerous at the beginnnig of 1936 than a year before. There were 1,701 unlicensed aircraft on January 1, 1936 as compared with 1,983 on January 1, 1935. The total of all civil aircraft in the United States on January 1, 1936 was 9,072, as against 8,322 a year before.

Among the 14,805 persons holding pilots' licenses as of January 1 were 7,186 transport, 909 limited commercial, 5,961 private, 746 amateur and 3 industrial pilots. The licensed pilots included 410 women classified as follows: Transport, 71; limited commercial, 29; private, 256; and amateur, 54.

New York had the largest number of licensed aircraft, 937; the largest number of licensed gliders, 50; and the largest number of limited commercial pilots, 131. California has the most pilots, in all classifications, with 2624.

Sales

A. S. Menasco, president of Menasco Manufacturing Co., announced the receipt of a substantial order through Commercial Steels, Ltd. (Australia) for Menasco B6 "Buccaneer" engines and spare parts for a new Australian light airplane manufactured in Sydney. The first engine is to be shipped immediately. The "Buccaneer" engine adopted by the Australian firm is a standard type which has been built and sold in this country for a number of years. Additional sales are now under negotiation with certain aircraft builders in England who are interested in using engines of a make competitive to the English types.

* * *

Becoming the first lady in Kentucky to own an airplane, Mrs. Kenneth Kane, Lexington, Ky., has purchased a Taylor *Cub*, a two place monoplane.

* * *

Richard H. Depew, Jr., and Beckwith Havens, Fairchild distributors at Roosevelt Field, report the sale of Fairchild "24" three-place cabin monoplanes to Mrs. Peggy Remey and to Grover Loening.

Al Menasco

Personnel Notes

The appointment of Robert R. Osborn, chief engineer of the Curtiss Aeroplane & Motor Co., Inc., since 1934, as consulting engineer of the company has been announced. Don R. Berlin, project engineer, has been appointed to succeed Mr. Osborn as chief engineer, and Earl Slater, project engineer, has been appointed assistant chief engineer of the company.

* * *

New manager of the Atlantic Division for Berry Brothers is S. B. Totten who will have charge of the New York and Philadelphia branch districts known in the Berry organization as the Atlantic Division. For many years Totten was manager of the Detroit and Cleveland branches for the DeVoe & Reynolds Co., and his appointment as head of the Atlantic Division is a forerunner of the re-organization of this eastern territory.

* * *

W. R. G. Baker has been appointed managing engineer of the General Electric radio receiver section, with responsibility for both the engineering and the manufacture of its products, according to W. Stewart Clark, manager of the company's Bridgeport works. Although closely associated with General Electric's initial radio-development activities, Baker for the past few years has been connected with the RCA-Victor Co.

* * *

At a special meeting of the Board of Directors of The Timken Roller Bearing Co., R. C. Brower, secretary-treasurer of the company, was elected a director to fill the vacancy created by the death of J. G. Obermier. Mr. Brower joined the Timken organization in 1916 as assistant manager of The Timken Service & Sales Co., later becoming manager. He was then appointed assistant secretary-treasurer of The Timken Roller Bearing Co., being made secretary-treasurer in 1930.

(*Continued on following page*)

Digest of Recent Events

Ranger Off For Arctic Maneuvers

The aircraft complement of the U.S.S. *Ranger* will engage in maneuvers in Alaskan waters when the carrier arrives there from San Diego. For the first time, Navy pilots will endeavor to develop a technique for flying under sub-Arctic conditions. Among the problems they will seek to solve are: starting engines in low temperature; air navigation in freezing, fogbound weather; ice formation; and comfort of flight personnel. The carrier is expected to return to San Diego Feb. 21. JAN. 13

Hughes Lowers Cross-Country Mark

Roscoe Turner's transcontinental speed record of 10 hours 2 minutes 51 seconds was broken when Howard Hughes flew from Burbank, Calif., to Newark, N. J., in 9 hours 27 minutes 10 seconds. The plane was a Northrop Gamma powered by one of the new 950 h.p. Wright Cyclone G Series engines. Hughes flew non-stop and averaged 263.5 m.p.h. for the 2450-mile flight. JAN. 14

French Flying Boat Arrives at Pensacola

The Lieut. de Vaisseau Paris France's largest flying boat, arrived at Pensacola, Fla., fron Martinique after a flight in easy stages from South America. Th flying boat made a successfu flight across the South Atlanti from Dakar to Natal on Dec. 14 A sudden squall the day after th plane arrived caused it to capsize in the waters off the Florid shore where it had been moore after its flight. JAN. 1

FAIRCHILD PREFERRED . . .

-at the Pacific Aircraft Show . . . and by many scores of prominent and discriminating buyers who have carefully studied and compared the construction and flying features of various cabin planes . . . and decided on the outstandingly popular Fairchild "24"

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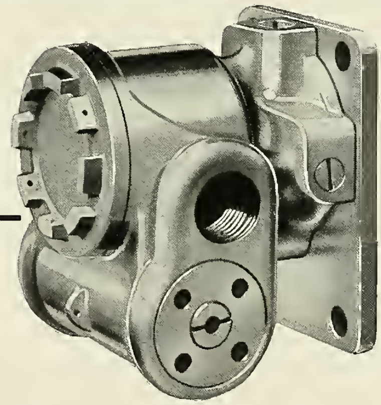

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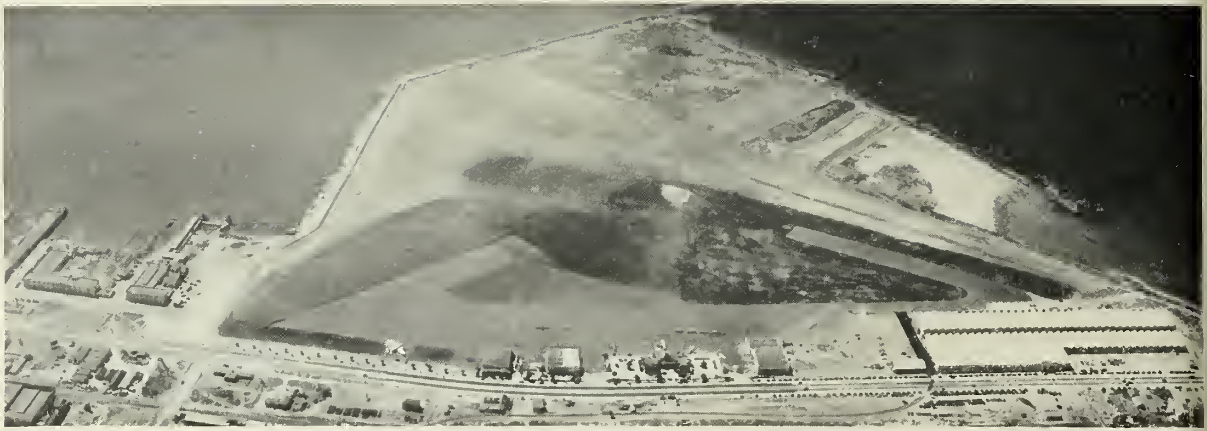


Photo by Erickson

Aerial view of Lindbergh Field, San Diego, Cal., showing new Consolidated Aircraft factory at the right

(*Continued from preceding page*)

Consolidated Plant

The accompanying aerial view of Lindbergh Field, San Diego, Cal., taken recently by Erickson the "Flying Photographer" shows at the extreme left the *Spirit of St. Louis Building* of the Solar Aircraft Co. At the lower center of the field are seen the United Air Lines hangar, Airtech and U. S. Coast Guard hangar, Administration building in which the Ryan School is located, and the hangar and factory buildings of the Ryan Aeronautical Corp. At the extreme right is a view of the new Consolidated Aircraft plant.

New Stinsons

Ten distributors of Stinson airplanes flew away eleven *Reliants* in two groups last month and a score or more other dealers attended a sales convention at the Stinson factory in Wayne.

"The keynote of the sales convention this year," said B. D. DeWeese, president, "was planned selling. We convinced our distributors that we had taken a leaf out of the book of the automobile manufactures, the airlines and other industries who had the courage to increase advertising and sponsor intensive sales drives and thereby greatly improved the conditions of all business. They promised to cooperate in this campaign to help to get more people flying their own planes as the modern airplane has been so greatly improved that if more people know about it, more would buy and fly planes.

"We especially advocated the wide-spread use of statistical data, proving the safety of modern aircraft. We also secured their pledge to a campaign which should be effective in lessening accidents and convincing the newspapers and public in general that flying has become a safe unit in our transportation scheme. The situation in Europe is such that the export of American-made planes should greatly increase and that will help commercial builders, as many American manufacturers are also loaded up with government business.

"Selling will hit a new high this year," said Mr. DeWeese, "and all of us must improve some of the "hit and miss" methods we have been forced to use and lead our distributing organizations in such a manner that they increase sales and lower sales cost per airplane."

Awards

The Wright medal, presented annually by the Society of Automotive Engineers for the outstanding paper in the field of aeronautics, was awarded this year to William Littlewood, chief engineer of American Airlines. Littlewood's prize winning paper *Operating Requirements for Transport Airplane* was read at the last annual meeting of the S.A.E.

* * *

The Manly Memorial medal was awarded by the S.A.E. to Guy E. Beardsley, Jr., project engineer of Pratt & Whitney Aircraft. This award, offered annually for the best paper relating to the construction of, or research on, aeronautic power plants, was made for his paper entitled *An Automatic Power and Mixture Control for Aircraft Engines,* which was presented at a regional meeting of the S.A.E. in Hartford on April 26, 1935.

Guy E. Beardsley

Waco For 1936

The 1936 line of Waco aircraft includes the cabin and open types manufactured in the past, but with a number of improvements and new characteristics which indicate increased sales possibilities this year. Price range of the 4-5 place cabin series is from $4995 to $9650, the hig price being for the 320 h.p Whirlwind powered, and the low price for the 225 h.p. Jacobs powered jobs. The standard series i now designated as the S-6 series the custom as the C-6 series.

Basic equipment on the S-6 cabi will be the same as on the 193 standard cabin, including electri starter, generator (for batter ignition), wheel cuff and painte wings. New and attractive upholstery is provided and the fuselag has been refaired into more pleasing lines.

C-6 series has been given equa attention to make it more attractive. While the established lis price is higher than 1935, the increase has been slightly mor than absorbed in the extra equipment that has been made standar In addition to the basic equipment furnished on the custo cabin in 1935, Grimes electricall operated retractable landin lights, 70-gallon fuel tanks, indirect lighted instrument pan with Lord shock-proof mountin Curtiss Reed fixed metal propeller, and painted wings will a be furnished at the new pric without extra charge. A fin grade of mohair upholstery ha been selected for the 1936 mode and attention has been paid t soundproofing.

The F-5 open series also has ne equipment and improved characteristics. The most importa change in the F-6 is the arrangement whereby, when ordered ne at the factory, the ship can b equipped with a winter top ov the rear cockpit.

Coming Events

The National Pacific Aircraft and Boat Show will be held at the Los Angeles Pan-Pacific Auditorium under the management of Cliff and Phil Henderson. Feb. 1-9.

•

The Seventeenth Annual Aviators Ball will be held at the Hotel Pierre, New York, under the auspices of Aviators Post 732, American Legion, C. S. Jones, commander. Feb. 21.

•

Closing date for entries in the Seventh Annual W. E. Boeing Scholarships, Boeing School of Aeronautics, Oakland, Calif. Mar. 15, 1936.

An International Aero Exhibition will be held in Stockholm, Sweden. May 16-June 1, 1936.

•

1936 National Air Races will again be held at Cleveland Municipal Airport. Sept. 3-6, 1936.

•

A 7060-mile round-trip speed and handicap race between Paris and Saigon, and sponsored by the Aero Club of France, will start from an airport near Paris. Oct. 1936.

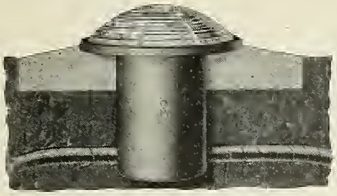
•

15th International Aeronautical Salon is scheduled to be opened at Grand Palais, Paris, November, 1936.

Indianapolis Installs
Pyle-National
FLUSH-TYPE RUNWAY MARKERS

★ The new instrument approach system, now being built at Indianapolis Municipal Airport, will be equipped with Pyle-National Flush-type Runway Marker Lights on the landing runway.

Write for Bulletin 210-B-1 with data on the complete Pyle-National line.



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If you're looking for any of the aviation crowd, you'll most likely find them after Show hours at

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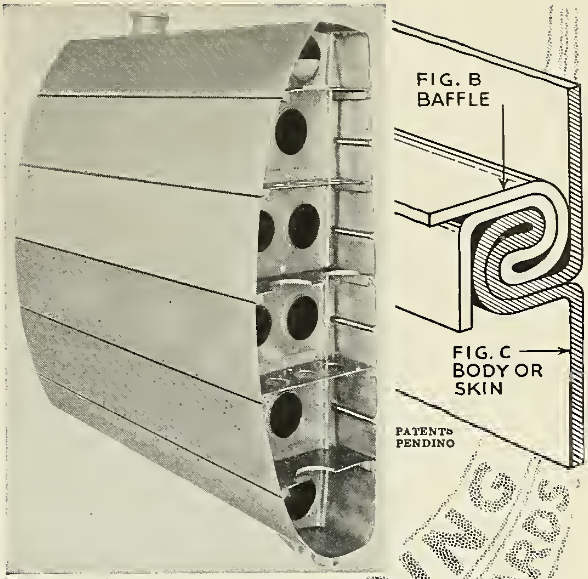

PH. J. BILLIG, Jr., Chief Engineer

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is gaining higher levels with its vibration-proof TANK. This TANK has successfully withstood the test of over 100 hours of vibration and was drop-tested with an 80% overload.

The seemingly never-ending problem of skin fractures or tearing away of bulkhead flanges from the skin, due to the old methods of riveting, has been solved by the use of a HOOK TYPE ROCKER ACTION TRACK JOINT. The result is greater FLEXIBILITY.

You are under no obligation in requesting designs and estimates on all airplane requirements. This service comes under the new, EXCLUSIVE and IMPROVED PARAMOUNT method.

Our representative, LT. L. HAASE (U. S. Navy, retired) will be at the AIRCRAFT SHOW. He can be consulted at the HOTEL BILTMORE, Los Angeles, for further details.

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FOREIGN NEWS IN BRIEF

Australasia

The Commonwealth Meteorologist has arranged with Amalgamated Wireless Ltd., for the operators of that company, situated on Willis Island, to send complete daily weather reports, in order that weather bureau officials at Brisbane, Sydney and Melbourne can advise air transport companies with greater accuracy as to the weather they are likely to meet on scheduled flights.

The Australian Air League is negotiating for a large area of land at Randwick, N. S. W., as a preliminary to the formation of a national flying school in which flying will be taught at nominal cost, and where pilots would be instructed in aircraft construction and engineering.

Beacons to assist in night flying between Sydney and Melbourne are to be erected at Goulburn, and between Bowral and Mittagong, N. S. W.

The Commonwealth Government has lifted the ban on the importation of foreign aircraft, with the result that Holymans Airways will put a Douglas into service between Tasmania and Sydney, via Melbourne, as soon as possible, while it is expected that other airlines will now use American equipment. New Guinea interests had previously complained that their operations were hampered owing to the necessity of using British aircraft, which were not always suitable, and it is expected that portion of £50,000 to be spent on new planes by airlines in Australia, will go to America.

Several shipments have already been made from England of Avro *Cadet* trainers which will be used for instructing pilots of the Royal Australian Air Force which is beginning a period of expansion in size and function.

Weekly passenger and mail service between Bombay and Trivandrum, Travancore via Goa, Portuguese India, and Cannanore, has been inaugurated by Tata and Sons which has a contract with the Government of India covering the transportation of air mail.

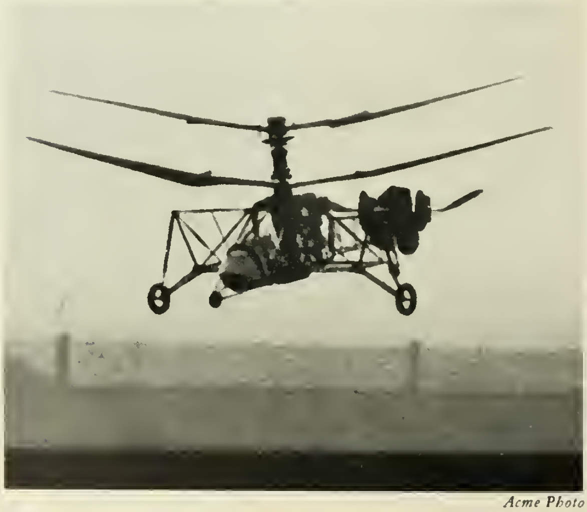
Canada

The Canadian government has bought for the Royal Canadian Air Force a number of new airplanes, including four for coastal defence plans and a similar number for photographic work. Two of the latter are to be Fairchild Super-71s and two new Northrops. The four coastal planes are the *Shark* type made in England by the Blackburn Aviation Co. Each carries 1500 lb. torpedoes or an equal weight in bombs, and can also carry aerial survey and photographic equipment, and can be used for artillery spotting and reconnaissance. A supplementary fuel tank slung in the torpedo crotches gives a cruising range of 1100 miles.

Toronto Flying Club members flew 1750 hours during 1935, an increase of 400 hours over the previous year. Its instructor, Ken Main, has taken an advanced blind flying course at Camp Borden, R.C.A.F. base, in connection with proposed tightening of pilot license requirements during 1936, when instrument flying will be a necessary qualification. As assistant instructor J. A. Wright, formerly with the Vancouver and Fort William Flying Clubs, has joined the Toronto Club.

Latest Canadian government reports on civil aviation, to the end of September, 1935, show 423 active private pilots, 473 commercial pilots and 451 engineers. There were at that time 43 private planes licensed, 340 commercial planes and 102 air harbors. Air mail continues to increase, despite the lack of inter-city services. For the first nine months 804,000 pounds were carried, as compared to 625,000 for 1934. Twenty-three air mail routes were in operation, practically all in the north country, serving mining camps and remote settlements. Twenty-two light airplane clubs throughout Canada flew a greater number of hours during the first nine months of 1935 than throughout 1934, with a total of 10,643 hours. While this is below the record of 1929, it is expected that final figures for the year will show approximately the same number of hours as in 1930, when more than 14,600 hours were flown by 3600 members. There are now 2,300 members, with 78 airplanes. New members under instruction total 606, while 55 private flying licenses and 12 commercial pilot licenses were issued during the first nine months of 1935.

DeHavilland Aircraft of Canada, Ltd., reports an increase of 76 percent in turnover by comparison with the last fiscal year for the twelve months ended September 30, 1934. The annual statement shows a net profit of $4,977, which compares with a trading loss of $1,779 for the year ended September 30, 1934. In his report to shareholders, F. L. Trethewey, chairman of the board, states that the improvement can best be shown by comparison of the gross trading profit before allowing for depreciation. For the 1934 fiscal year, a loss amounting to $6,192 was shown. This figure included non-recurring expenditures connected with staff reorganization amounting to $4,421, so that for purposes of comparison the trading loss should be taken at $1,779. This compares with a trading profit of $10,499 for the period under review. The directors decided that full depreciation should be taken on the company's assets and $7,536 has been added to the depreciation reserve fund for this purpose.



Acme Photo

Hispano-Suiza powered Breguet-Dorand helicopter in flight

A large frame hangar and five planes were destroyed by fire at Barker Field, an airport a few miles north of Toronto, with loss estimated at about $50,000. One of the planes was owned by Col. Douglas C. Joy, Superintendent of Civil Aviation for the Department of National Defence. The others were owned by National Air Transport Co., owners of the field.

Winter passenger service between Prince Albert and Goldfields on Lake Athabaska has been inaugurated by Canadian Airways, Ltd. This makes three companies operating between these points, including Wings, Ltd., and M. and C. Aviation Co., Ltd.

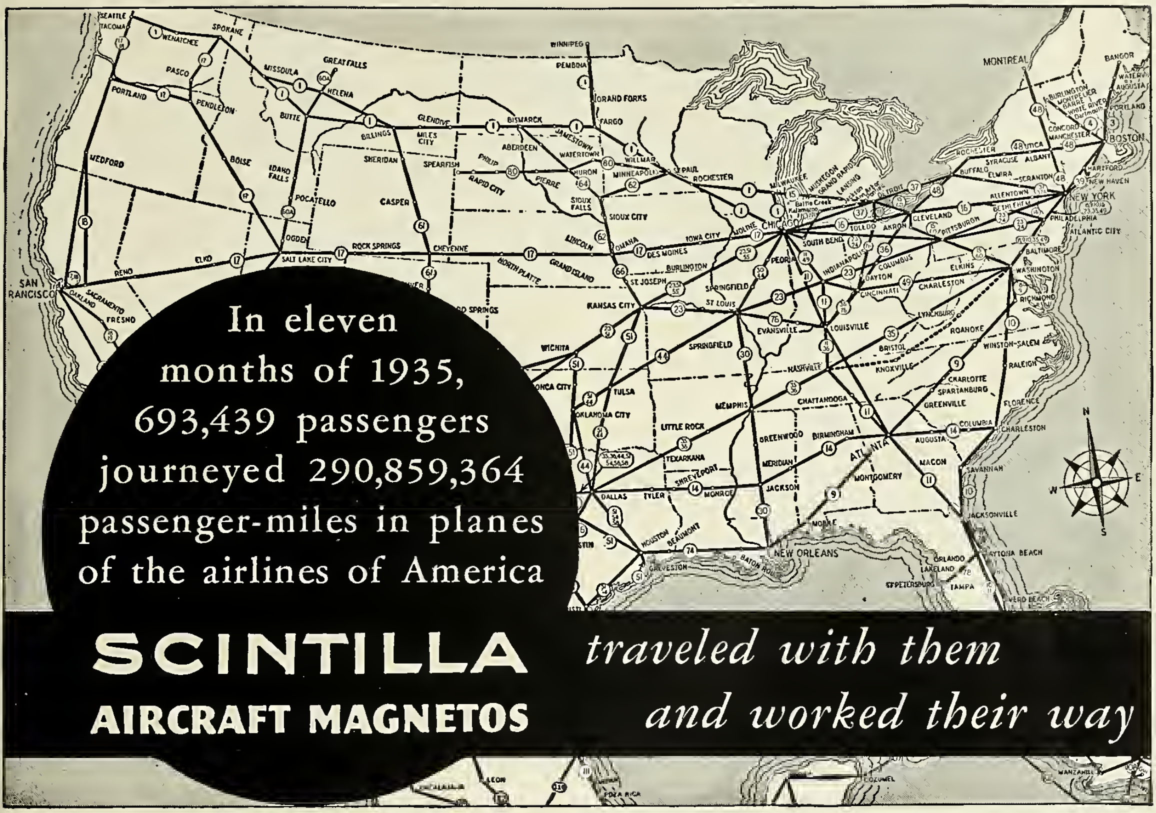
Ontario Air Service flying hours in 1935 were approximately 2,000 less than during 1934, the lowest since inception of service, according to Director George Ponsford. Total flying time was 4,749 hrs. 10 min., compared with 6,752 hrs. 20 min. in 1934. The decrease was due to efforts to dispense with unnecessary flying.

France

Test flights of the 350 h.p. Hispano-Suiza powered Breguet-Dorand helicopter in France showed that the craft can attain a speed of at least 62 m.p.h. At present, the machine weighs more than 2 tons, and the diameter of the blades which rotate at 132 r.p.m. is 52 ft. They are geared at a ratio of 16.7:1, and are of duralumin construction, the leading edges being covered with duralumin sheet, fabric covering being used on the balance. Framework of the helicopter is of steel, and electrically-welded duralumin tubes have been used in the construction of the engine mount.

Regular schedules are now in operation between France and Madagascar on a weekly basis.

(*Continued on following page*)



In eleven months of 1935, 693,439 passengers journeyed 290,859,364 passenger-miles in planes of the airlines of America

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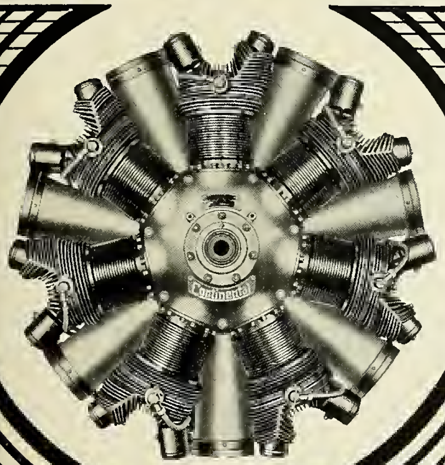
traveled with them and worked their way



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Aircraft Engine Division
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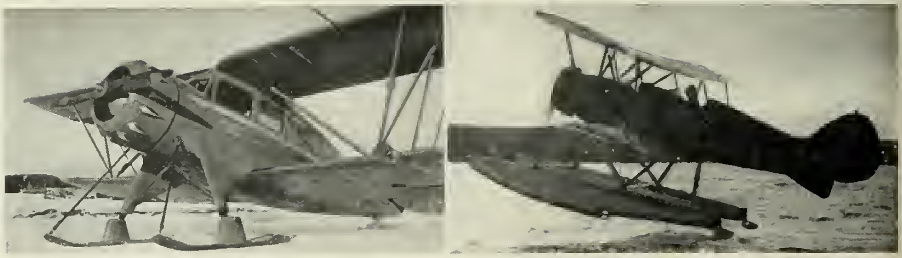
(*Continued from preceding page*)

This service is in accordance with a plan established by the Air Ministry.

Le Bourget will be improved, at a cost estimated to be $1,318,000. An express highway between the airport and the city will be built; this will result in travel between the airport and city in one-half the time now required. Some 20 proposals for the rebuilding of the airport have been accepted for study. Extensive passenger, customs, mail, weather and other facilities will be provided in new buildings.



Waco Cabin on skiis and a float equipped Waco "F" owned by Wideröe of Oslo

An up-to-date airport will be built by the city of Dieppe with the cooperation of the State. The area of the airport amounts to 1,235 acres, and it measures 1,968 by 2,624 ft. with a grass surface. Dieppe is on the Paris-London air route and a large hangar and passenger depot will be provided.

It has been decided to build three more seaplanes of the *Lieutenant de Vaisseau Paris* type. This action follows final tests of the first plane and the new planes will be used, as is the original, in the trans-Atlantic section of the Air France service between Europe and South America.

Great Britain

High performance, capacity to carry a considerable useful load and cabin comfort are outstanding features of a new monoplane which embodies many of the ideas in the interior of a modern automobile. Powered with a 200 h.p. deHavilland Gipsy-Six, the plane, called the *Vega Gull*, accommodates four persons and their baggage in a roomy cabin at a cruising speed of 150 m.p.h. and a maximum speed of 170 m.p.h. The seats are arranged in two pairs. Those in front are of the bucket type, with dual flying controls; the rear seats have arm rests. Walls are soundproofed, shatterproof windows slide and there is a wide door on each side and ample space for luggage in a separate compartment behind the rear seats.

F. S. Spriggs, for many years a member of the staff of the Hawker company and recently one of its directors has been appointed managing director of the Armstrong Siddeley Development Co. A few months ago Spriggs was one of the men who formed the board of Hawker-Siddeley Aircraft, Ltd., a holding company which acquired the ordinary share capital of the Armstrong Siddeley Development Co., and a half interest in the Hawker concern. The Siddeley group includes among other interests Armstrong Siddeley Motors, Armstrong Whitworth Aircraft, and A. V. Roe and Co.

Since winter schedules were put into effect early in October, more than 1500 passengers flew on the Imperial Airways night service between London and Paris. Each service has carried on the average of ten passengers.

Cruising at a height of 40,000 ft., and at a speed of almost 300 m.p.h. is forecast by Professor G. T. R. Hill, Professor of Engineering at London University, as a possibility of airline travel in the near future. Professor Hill designed the Westland Hill Pterodactyl tailless plane, of which the latest, a military two-seat fighter powered with a Rolls-Royce steam-cooled engine, is under test at Martlesham Heath, land-plane experimental station of the Royal Air Force. He takes as a basis a passenger transport of relatively small size, weighing 9,000 lbs. fully loaded and carrying up to five passengers more than 2,500 miles. He limits maximum horsepower to 800 and assumes propeller efficiency is 80%. Engines are assumed to be fully supercharged to a height of 30,000 ft., after which the normal loss of power in a further 10,000 ft. will enable the craft to cruise economically at full throttle (but on two-thirds power) at the required altitude of 40,000 ft.

Imperial Airways will attack the problem of flying the Atlantic along two main lines. Engaged in the experimental crossings will be one of the large four-engined monoplane boats now being built at the Short works and the Mayo composite aircraft which employs a large flying boat as the aerial launching platform of a smaller and heavily laden four-engined seaplane. The craft takes off under the power of eight engines —four Pagasus 900 h.p. units in the "bearer-plane" and four Napier Rapier H-shaped 350 h.p. engines in the upper component. At about 10,000 ft., the two machines separate and the upper component continues the journey alone.

Performance figures for the Gloster *Gladiator* day and night fighter, which has been ordered in quantity for equipment of Home Defence squadrons of the RAF, are disclosed. They reveal another forward step in the speed of military aircraft. As a development of the 231 m.p.h. Gloster *Gauntlet*, now in service, the *Gladiator* is a biplane powered with a Bristol *Mercury* IX supercharged engine rated 685-715 h.p. Its maximum speed with full load at 15,500 ft. is 260 m.p.h.

The new transport produced by Short Brothers is a high-wing, cantilever seaplane called the Short *Scion Senior*. It is powered with four 90 h.p. engines, seats seven passengers, and has a maximum speed in excess of 130 m.p.h. The machine can be converted into a landplane by substituting a wheel undercarriage for the floats.

Norway

In order to start regular service to the mountain regions visited by a great number of tourists, Wideröe Aviation Co., Ltd., has applied for the concession of a daily line from Oslo to Jotunheimen. If the permit is granted, the line will be operated with a seven-passenger Bellanca. The company has also applied for permission to operate a daily line from Oslo to Stockholm and a night mail service between Oslo and Gothenburg. The former will be flown with a Lockheed Electra.

Russia

18,000 persons, according to Osoaviakhim, have received the parachute emblem and about 140 clubs are now organized in various parts of the country to train them. Gliding is being developed on a large scale this winter. Contrary to the usual practice, the gliding season will be continued through the winter. In Moscow a group of glider pilots has been organized to make trial and record flights under winter conditions. Contemplated flights in snowstorms are of special interest inasmuch as meteorologists are of the opinion that a glider attached to an airplane can, during a snowstorm, develop great speed and remain in the air for a considerable length of time. Last year there were 230 glider stations, at which thousands of people learned the art of gliding.

One hundred airplanes are being operated at present by industrial organizations throughout the country. The organization building the Balkhash copper foundries has seven planes; the Central Asiatic Oil Trust has three planes for communication with research geological expeditions; Eastern Oil Trust operates seven planes; and a unit of Donets electric stations has three planes. The aviation division of the Peoples Commissariat of Heavy Industry flew 124,370 miles in 1935, performing various kinds of work. Directors from distant places flew to Moscow for conferences. Freight needed urgently was brought to its destination by plane, as were construction plans; and specialists were sent by air to handle emergency situations at one place or another.

South America

Construction at Buenos Aires of a combined municipal land and sea airport at a cost of $3,283,000 has been proposed in a bill recently presented. This airport would be constructed on the water front in the northeastern section of the city and it would contain hangars, a passenger depot, administrative offices and a breakwater. The airport would permit passengers and mail to be landed within the city, and be of great advantage from a military viewpoint.

An extension of the National Air Line is now operating between Santiago and Puerto Montt via Chilian and Temuco. The service is on a weekly basis with the southbound plane leaving Santiago Wednesdays at 9 a.m. and returning on Friday. Passenger fares amount to: Santiago to Chilian, $10.30; to Temuco, $20.60; to Puerto Montt, $30.90. Round-trip fares are subject to a 10 percent discount.

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THE MUSIC GOES 'ROUND

(*Continued from page* 23)

has never been in aviation before; it is all new and thrilling to him. He used to run the Redpath-Horner Chautauqua Bureau in Kansas City, a cultural and stock yard center of the Middle West. He also ran an Institute of Fine Arts there, adding materially to the culture of that burg. I asked about this Fine Arts Institute and learned that the Arts included sculpture and aesthetic dancing.

Now, if there is one thing that I am practically nuts about it is aesthetic dancing—especially with a fan or a bubble. So I asked Mr. Horner if he had taught fan dancing at his school of culture. No, he had not. I was grieved to learn that and pointed out that a man not progressive enough to teach fan dancing in his school was not progressive enough to lead aviation. I was sorry to learn that Sally Rand had beaten him at his own game.

He also has done some stout work in the late lamented war to make the world safe for something or other. He and Senator McAdoo fought shoulder to shoulder, selling Liberty Loan bonds. Mr. Horner made many addresses to groups of local Babbitts, and thus became something of an Old Master at the art of getting business men to shell out for a Worthy Cause.

He was elected, I am told, by this new progressive group in the NAA. At the convention Hiram Bingham put up Mr. Godfrey Cabot for president, but instantly ran into a Cone of Silence, and had to withdraw his entry. Hiram, an expert in steamroller tactics at conventions, had finally been flattened out himself—it was retributive justice.

What of the path ahead? Well, it seems to me that the NAA is heading into troubled financial waters, and President Horner will have to reef in his sails to weather the storm. In the last six months the NAA received and also expended $41,000, including new membership fees and a donation of $15,000 from the aviation industry. This spending has been at the rate of $80,000 a year—which is some rate for an association with only 4,000 members at $5 or $3 a year, the new membership fee. With only that amount being contributed by the members the puzzle is to find out where the rest of the money is to come from.

The sad thing about the NAA is that it has been dying for years and when it is about at its last financial gasp, some unsuspecting soul comes along and gives it a blood transfusion—Mr. Cabot has been donating for years. Now Mr. Cabot, flattened out at the convention, is slightly discouraged, so Mr. Horner will have to seek new donors. He will have to hunt

(*Continued on following page*)

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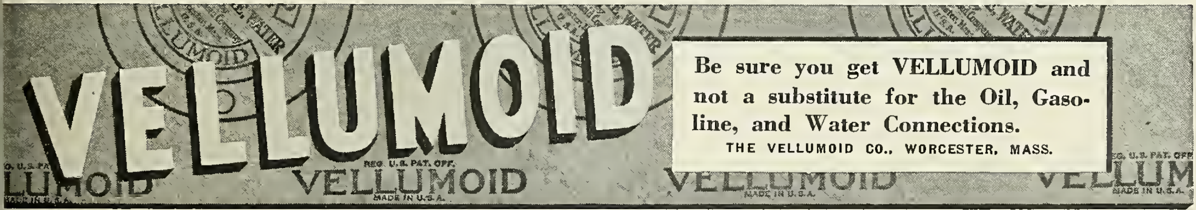

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(*Continued from preceding page*)

an angel, and hunt fast. The aviation industry, which helped him out to the tune of $15,000 last year, is still waiting for financial reports which, I learn from the Treasurer, have not been sent to them. They naturally are wondering what happened to their $15,000 and who, besides Mr. Horner, got part of it.

Here we have an association that has been dying for years. Now we have a new group in control, and it may possibly get somewhere. Land knows we need just the sort of association that the NAA is supposed to be—though we do not need the sort of personal publicity organization that it has been in the past. It is unfortunate, however, that we have no nationally known and respected aviation person to head the organization.

Mr. Horner may be the fair-haired boy who will lead the children of aviation into the promised land. If he is, then I'm for him, and will even reverse a long-standing decision I have made never to join the NAA. I felt that the burden of proof rested with the Association.

The industry has been fooled many times before by these spasmodic spurts of the NAA. Many times before money has been donated by the industry and by private individuals to further the cause of aviation. And too many times we have found that the NAA was used principally to further the social and political ambitions of those in control of the Association. In a few months' time the NAA will demonstrate whether it is really going places, or whether like the music in the popular song, it will continue to go 'round and around—woe-owe-ho-ho-o-o-o-o-!

AIR COMMISSIONS

(*Continued from page 32*)

development of aeronautics. The following shows how aviation is controlled by the various states, omitting those states where no organization is specifically charged with aeronautics.

*Alabama—State Aviation Commission of 1 to serve 4 years without pay.

Arizona—Corporation Commission (controls only common carriers).

*California—Aeronautic Commission of 3 to serve at pleasure of the Governor, without pay, providing that the state delegation of licensing power to the Department of Commerce is held unconstitutional, as was the case in Minnesota.

*Connecticut—Commissioner of Aeronautics to serve 4 years at $4200; in addition a State Airport Commission of 4 to serve 4 years without pay.

Florida—State Comptroller for regulation; Aviation Division of State Road Department for development.

Idaho—Department of Law Enforcement for regulation; Commissioner of Public Works (Aeronautics Division) for development.

*Illinois—Aeronautics Commission of 5 to serve 4 years without pay.

*Iowa—Commission of Aeronautics of 3 (within the Department of the Adjutant General) to serve 4 years without pay; Board of Railroad Commissioners for airports.

*Kentucky—Air Board of 5 to serve at pleasure of Governor without pay.

Louisiana—State Inspector of Aviation as a member of the Highway Commission.

Maine—Secretary of State (Aviation Division established under a Chief Inspector).

*Maryland—Aviation Commission of 6 to serve 3 years without pay but secretary-treasurer thereof at $1500.

Massachusetts—Registry of Motor Vehicles with advisory board of 5 air experts serving 5 years without pay.

*Michigan—Board of Aeronautics of 5 to serve 4 years without pay.

*Minnesota—Aeronautics Commission of 5 to serve 4 years without pay.

Montana—No commission legislation but the Governor has informally appointed a Commissioner of Aeronautics.

*Nebraska—Aeronautics Commission of 5 to serve 4 years without pay but may have a secretary at $4000.

Nevada — Public Service Commission (jurisdiction over common carriers only).

New Hampshire—Public Service Commission (With an Aviation Inspector.)

*New Jersey—Department of Aviation of 5 to serve 5 years without pay and a Director of Aviation to serve 5 years at $5000.

New Mexico—Corporation Commission.

North Dakota—Board of Railroad Commissioners.

*Ohio—Director of Aeronautics to serve at pleasure of Governor at $5000.

Oklahoma—State Highway Commission.

*Oregon—Board of Aeronautics of 5 to serve 5 years without pay.

Pennsylvania—Department of Revenue (Division of Aeronautics).

Rhode Island—Department of Public Works (Division of State Airports).

*South Carolina—Aeronautics Commission of 3 to serve 4 years without pay; Commission to employ a Director of Aeronautics at not over $3600.

*South Dakota—Aeronautics Commission of 3 to serve 4 years without pay.

*Tennessee—Aeronautics Commission of 5 to serve 3 years without pay and an additional Director of Aeronautics at pay fixed by the Commission.

Vermont—Commissioner of Motor Vehicles.

Virginia—Corporation Commission.

*West Virginia—Board of Aeronautics of 3 to serve 2 years without pay.

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* Commission may employ personnel out of revenues under the air act or otherwise as case may be. In the other states air personnel are employed, (where employed), out of general funds of the control authority.

WRIGHT WHIRLWINDS

(*Continued from page 40*)

system with the amount consumed. Hence the breakage in flight of one or all of the external tubes connecting all of the cylinders in a continuous circuit would not necessitate a forced landing due to loss of engine oil.

Mechanism for the operation of a hydro-controllable propeller gives the operator of a Whirlwind 320 or 450 the choice of using any suitable type of fixed or controllable pitch propeller commercially available. The control unit consists of a special valve, incorporated in the nose section of the crankcase, which provides for the regulation of the oil pressure to change the pitch of the blade as desired.

In order to provide greater clearances for the accessories in installations where the engine is mounted in rubber, an additional set of mounting lugs have been cast integrally with the intake pipe bosses on the crankcase of the Whirlwind 450. The mounting diameter of 23.375 in. provided by the new lugs is identical with that of the Wright Cyclone. Retention of the previous mounting lugs provides two mounting diameters from which to select that most suitable to the installation. The smaller mounting diameter is 19.25 in. The larger circle provides improved clearances facilitating adjustments on the rear section of the engine.

ALUMINUM DEVELOPMENT

(*Continued from page 29*)

veloped and the aircraft industry was educated in their correct use, with the result that, today, the prevention of corrosion is no longer an important problem.

Still another situation confronted the aircraft industry in its efforts to employ metal construction. In the early years, existing knowledge regarding the aluminum aircraft materials was quite limited, even within the aluminum industry. Information of these matters possessed b the aircraft manufacturer and workman was even less. The questions requiring answer were legion. What type of equipment was best for forming simple shapes complex shapes? What were the effect

(*Continued on following page*)

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WRITE FOR NEW CATALOG

(*Continued from preceding page*)

upon the properties of the metal of this or that type of forming operation, or this or that degree of cold working? What equipment was most suitable and what were the correct shop practices for riveting the aluminum alloys? Should the rivet holes be punched or drilled? What was the most reliable and satisfactory type of heat-treating equipment for sheet and just how should the operation be conducted? The situation called not merely for developing the correct technical facts and truths involved but disseminating the information adequately throughout the aircraft industry, and in a manner that would assure correct application. Has progress been made in this respect? The larger manufacturers of aluminum aircraft in this country, should they now desire to revert to the use of wood, probably would encounter even greater difficulties in changing equipment and acquiring and training personnel than they experienced originally in changing from wood to aluminum alloys.

The net result of the needs of the aircraft industry and of the efforts made is that whereas in 1925 substantially less than 10% of the structural weight of aircraft built in the United States consisted of aluminum alloys, this figure at the present time is well in excess of 70%.

Neither the fact nor, much less, the date of a future discovery can be predicted definitely. However, by examining in retrospect the nature and magnitude of such progress as has been effected, especially in the recent past, one may draw some reasonably accurate conclusions as to what the future may hold.

As has just been explained with reference to that all-important matter, the strength-weight ratio of materials of construction, we see that in less than twenty years the guaranteed minimum yield strength of aluminum alloy sheet has been increased 100%. While those matters which affect the aerodynamical performance of a plane have been, and probably always will be dominating, the economics concerned, especially in the commercial field, are increasing persistently in their importance.

There are many factors involved in the broad subject of economy, but one important phase is the plane's original cost and expense of maintenance. In 1927, the Aluminum Company of America made available a new product, namely, Alclad 17S-T sheet. Description of this material has been covered amply in other publications. The important matter here concerned is the remarkable and outstanding durability of the product. Based on this feature, the aircraft industry has been giving increasing consideration to the use of the material in its bare state, without any protective coating of paint, and relying on the inherent durability of the material itself. If this should prove successful, considerable savings would obviously be effected both in original cost and in expense of maintenance. What are the prospects? Fortunately, we can now step out of the laboratory and look to actual service experience for the answer. The skin-covering material of the later Ford transports was bare Alclad 17S-T. The modern Douglas DC transports are also built in this manner, employing Alclad 24S-T. It is reasonably safe to say that this general idea will find increasing application and indications are that this will not be limited to landplanes.

Progress is being made in the elimination of heat-treating, with its attendant expense, in the aircraft plant by the development of design and shop practices permitting the wider employment of the metal as heat-treated by the producer.

Equipment and technique have been developed within the past few years which permit satisfactory joining of aluminum alloy parts by electric resistance welding, both spot and seam. This development has progressed to the stage where several plane manufacturers and government agencies now have suitable equipment installed in their plants and are proceeding with the experimentation necessary to adapt this method to production.

BOOK REVIEWS

BIRD FLIGHT

By G. C. Aymar

A book which should be interesting as well as educational. *Bird Flight* contains more than 200 photographs and diagrams and is divided into four main sections. One deals with the evolution of flight in birds, another with their biology, a third with their migration, and the last with the aerodynamics of flight as pertaining to birds.

The discussion of the way a bird propels himself through the air or soars on practically motionless wings is worthy of the attention of aeronautically-inclined persons, and the action photos should be helpful in attempting a comprehensive study of flight as gleaned from birds.

DIESEL ENGINEERING

By Orville Adams

Written by the author of *Modern Diesel Engine Practice*, Henley Publishing Company's text *Elements of Diesel Engineering* has been published to help prepare those who plan to enter the Diesel engine field.

It is useful for instructing the person who has little or no experience in this field, and contains questions and answers with each of the 20 chapters. Important points are fully discussed, illustrated by charts or diagrams, and explained in clear and easy style. *Elements of Diesel Engineering* treats on all essential operating principles and maintenance engineering, written in non-technical language easily understandable to the man in the production and service end of the industry as well as operators and engineers in the field.

FLIGHT MANUAL

By Cloyd P. Clevenger

One of the most recent literary contributions to a practical explanation of the art of flying is the *Flight Manual* by Cloyd P. Clevenger published by the Porterfield Aircraft Corp. This book deals basically with methods of instruction which facilitate the injection of flight knowledge in the student. Logically divided into two sections, called the first and second grades, the former treats with an introduction to the fundamentals of flight and takes up the stages of flight instruction to the solo point. The second section deals with the various stages of practice to mature the flying ability of the student.

Diagrams accompanying various maneuvers are well done, and the book should find ready acceptance among flying instructors.

AIRCRAFT MANUAL

By Jack Lincke

A new text on aircraft and engine maintenance and repair has been released by Aviation Press, San Francisco, Calif. The work of Ensign Jack Lincke, U.S.N.R., the book contains 300 pages and is illustrated with more than 180 engineering drawings and photographs. It is divided into ten chapters, the first of which deals with maintenance as a safety and operations factor and includes a sub-chapter which contains a complete examination for an airplane and engine mechanic's license together with answers and references to the text. The other nine chapters are on engines, electrical systems, fuel and oil systems, fuselages, wings, landing gear, instruments, auxiliary equipment, with a special section on autogiros.

The text explains what defects appear most frequently in the various assemblies and parts, how these manifest themselves, how to repair or recondition them, and how to guard against a recurrence. Complicated assemblies such as magnetos, carburetors, instruments, and controllable-pitch propellers are explained and illustrated.

There also is data on seaplane maintenance, an analysis of salt-water corrosion problems, and kindred water-operations data.

ARC WELDING

A revised and enlarged edition of *Procedure Handbook of Arc Welding Design and Practice* has been issued by the Lincoln Electric Co., Cleveland. The present volume, encyclopedic in scope and content, is some 140 pages larger than its predecessor, containing 586 pages, divided into eight principal sections which deal with an important phase of arc welding. The text is written simply and concisely, containing more than 700 illustrations consisting of detailed drawings and photographs. Practically every use and application of arc welding is covered.

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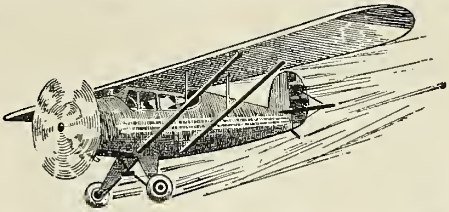

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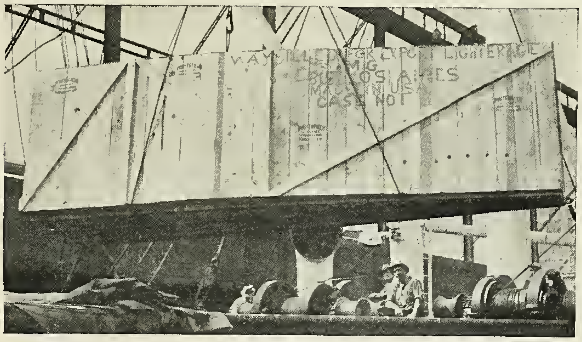

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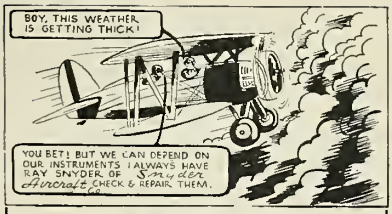
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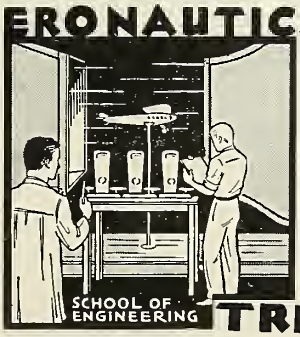

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Waco F-3, Continental powered, excellent condition
Waco C, 1933, Continental powered, many extras, special color
Waco C, 1934, Continental powered, special paint job, prepared for radio
Waco Custom, 1935; Jacobs-powered; fully equipped for blind flying
Waco J-5 Taperwing, recently recovered, motor majored; priced for quick sale

Travel Air Speedwing, KR-34, Curtiss Wright Speedwing, Moths, Robins, Privateers, Sikorsky, Monocoupes and many other types, as low as $500.

Trade or terms to responsible parties
Write for new time payment purchase plan
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AIRPLANES

Stinson U Trimotor	$5,000
Fairchild 71, Wasp D, special photographic ship, U. S. Army specifications	5,000
Ford Trimotor, J6-9 D's	4,000
Lockheed Air Express	3,000
Monocoupe D, 145	3,000

ENGINES

All newly overhauled; no time since majored.

Wasp B, total time 450 hours	$ 900
Wasp C, total time 850 hours	1100
Wasp C-1, total time 1400 hours	1250
Wasp D, total time 350 hours	1900
Wasp S-1-D-1, 300 hours	2250
Wright J6-9-D, 350 hours	1000

HOEY AIR SERVICES

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Telephone: Nightingale 4-4200

OX TRAVEL AIR: Detachable engine mount, being relicensed, $500. J6-7 STEARMAN: fully equipped, licensed Dec. 1936, Lear radio, $1,850. CONTINENTAL WACO: 1932; ambulance and night flying equipment; licensed Nov. 1936, $2,750.

WACO CABIN: 1935 Standard model, Jacobs 225 engine, electric starter, generator, 150 hours total time; like new, never damaged. Price on request. Standard Steel Propeller for Challenger or Lycoming engine, $95; also one, as is, for Lambert engine, $35.

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AIRCRAFT DEALERS & DISTRIBUTORS

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AERONCA (See page 73)

AERONCA DISTRIBUTORS
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Jacobs Cabin Waco; Stinson '33 and '34, also "S"; Great Lakes Trainer; Warner Monocoupe; Lambert Monocoupe; Privateer Amphibion; J6-7 Travel Air; Bellancas; 145 Warner Monocoupe; Fairchild 24; Kinner Fleet; Aeronca. Cracked-up Laird.

FAIRCHILD (See page 75)

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AIRCRAFT SALES CO.
FAIRCHILD DISTRIBUTORS
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Continental *Jacobs*
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● PLANES and ENGINES FOR SALE

AIRPLANES ADVERTISED IN THIS SECTION: *Aeronca, American Eagle, Argo, Autogiro, Barling, Beechcraft, Bellanca, Buhl, Cessna, Curtiss Fledgling, Curtiss Junior, Davis, Driggs, Eaglerock, Eaglet, Fairchild, Fokker, Ford, Heath, Monocoupe, New Standard, Northrop, Pitcairn, Privateer, Robin, Ryan, Sikorsky, Stinson, Taylor, Travel Air, Waco, Wallace.*

ENGINES ADVERTISED IN THIS SECTON: *Challenger, Cirrus, Hispano, Hornet, J-5, J-6, Kinner, Lycoming, OX-5, Siemens-Halske, Tank, Wasp.*

BEECHCRAFT JACOBS: Demonstrator. 250 hours total time; 70 hours since top; motor and ship completely modernized; bank and turn, sensitive altimeter; pneumatically operated landing gear; never cracked. Price, $6,200. Beechcraft Sales & Service, Roosevelt Field, Mineola, New York.

SACRIFICE WACO F: Warner; needs prop and landing Vees; otherwise perfect; $995. Peter E. Aggergaard, Viborg, South Dakota.

OX-5 WACO: Good condition; motor just majored. Sell or trade on licensed air-cooled 3POLB. Balance paid monthly. Sam Bakshas, Box 303, Fort Peck, Montana.

AMERICAN EAGLE: Late series; detachable motor mount. 200 hours on ship. Completely rebuilt; fabric, cowling, propeller, motor all new. just relicensed. For quick sale, $350 cash. Extra overhauled motor at $25. Write or wire G. Lytle, Columbiana, Ohio.

SPEEDWING J-5 TRAVEL AIR: $950. Never cracked; fairing, ring, pants, tail wheel, extra instruments; cruises 120; recovered; relicensed December 1936. Ray Brown, Flushing Airport, Flushing, New York.

CESSNA C-34: 1935 model; total time under 25 hours; standard instruments, flaps. Owner buying larger ship. $4,500. AERO DIGEST, Box 2233.

STINSON 1933: A real buy. Complete equipment. Low hours. Must sell. Make offer. H. W. Bresee, 650 S. Salina Street, Syracuse, New York.

CLASSIFIED ADVERTISING

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Absolute closing date for March classified advertisements—February 19th.

TRAVEL AIR 6000: J-5; 6-place; 341 hours total; just completely recovered; just relicensed. New cables, new battery, landing lights, flares, booster crank starter, bank and turn, cabin heater. Just spent $450 on ship. Good ship to carry passengers for 50c. My intentions, forced to sell, price $1,375. Will accept late light car or light ship—Aeronca or Cub. L. J. Perry, 570 Portage Street, Kalamazoo, Michigan.

WACO CABIN 1933: Total time 338 hours; 12 hours since major overhaul. Ship always hangared; privately owned; best of care. Priced to sell. Tex LaGrone, Municipal Airport, Kansas City, Missouri.

WASP, TYPE SD: 500 h.p., only about 100 hours. Now at factory undergoing major overhaul. Ready soon. B. C. Skinner, Dunedin, Florida.

PLANES and ENGINES FOR SALE

DE LUXE STINSON S: Must sacrifice; has pants, speed ring, semi-airwheels, new tires, radio, bank and turn, airspeed, rate of climb, electric flares, landing and navigation lights, starter and battery; Stinson blue high gloss finish. Will sacrifice for $2,000 or with extra Lycoming motor and tires for $2,100. Travel Air E-4000, Wright J6-5, electric starter, 70 gallons gas, rate of climb, bank and turn, airspeed, $975 or will trade for Moth, Fleet or Waco F. OX-5 Waco 10, $250. Cash offers only. Hawthorne Flying Service, Charleston, South Carolina.

ALEXANDER EAGLEROCK: A-1. Ship NC licensed until July 15, 1936. $435. Pat Hanlon, Box 244, Philip, South Dakota.

MAKE AN OFFER: Aeronca C-3 landplane and Edo floats. First cash offer of $1,425 or highest cash offer over $1,250 received by February 29th buys the works. In excellent shape, treated for salt water and licensed land and sea, July, 1936. Has flown 176 hours since recovering and new factory fuselage, spars, ribs, propeller; 76 hours on floats (bought new) and 72 hours since factory majored E-113 engine with new crankshaft assembly, valves, pistons, springs, rings, carburetor, etc. J. K. Fenno, Providence Airport, Seekonk, Massachusetts.

BELLANCA PACEMAKER: J6-9. Perfect shape, modernized. 40 hours since completely recovered. New upholstering, one reclining chair; new Airwheels, tail wheel, 112 gallons gas, 8 gallons oil. Large tail surface, complete instrument board. Ship perfect condition. Black, paneled in yellow. Priced for quick sale. Leonard Air Service, Long Beach, California.

100 PLANES, $70 UP: Terms, trades, instruction. Big Winter directory, 25c postpaid. A practical course in acrobatics, fully illustrated, complete, $1. Aircraft Directory, Athens, Ohio.

OX-5 ROBIN: Licensed November, 1936; fabric excellent; new shatter-proof front; motor just overhauled; full Miller overhead. Serial 551; bargain, $425 cash. Leo Gilb, Tracy, Minnesota.

AUTOGIRO PAA-1: For sale, less rotors and motor. Sell as a whole or any part. Make offer. Andrew Flying Service, Honolulu, Hawaii.

WACO F: Kinner B-5. Completely recovered. Engine overhauled this summer. Excellent condition. High gloss finish. AERO DIGEST, Box 2229.

FOR SALE: Wasp Ford trimotor; Wasp Sikorsky S-38; good condition, luxuriously fitted for executive. To the highest cash bidder. Communicate A. W. Gorton, 32nd Floor, 630 Fifth Avenue, New York, N. Y. CIrcle 6-3200.

NEW AIRPLANES: $98. Motors, $49.98; propellers, $2.98. Send 25c for data, information. Hibbs, Dept. 8, Fort Worth, Texas.

DE LUXE LYCOMING STINSON R: $2,250; Taylor Cub, A-40-2, $900; Pioneer turn bank, factory overhauled, $30; airport radio, beam and weather receiver, $20. Trades considered. Valley Airways, Inc., Winchester, Virginia.

QUICK SALE: 3-place OX-5 Swallow. Perfect condition. Just recovered. $385. Sale, OX-5 motors and parts. Frank Garofalo, 36 Vreeland Avenue, Hackensack, New Jersey.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $750; Wasp S-1-D-1, $2,500; Wasp C, $1,100; Wasp B, $800. J6-9-D, $1,250; J6-7-E, $1,250; J-5, $450. Lycoming 215 h.p., $595. Challenger 185 h.p., $400. Kinner K-5, $300. Bahb, 1100 Airway, Glendale, California.

VELIE EAGLET: Special paint and extras; A-1 condition, excellent performance; unlicensed, $400. Don't delay. Trade on Warner F. C. Davenport, Route 2, Hickman Mills, Missouri.

OX-5 WACO TEN: Completely rebuilt at Ryan Aeronautical Co. in August. Not flown since. Millerized; air wheels; good dual instruments; beautiful finish. $525 without propeller. See at Ryan Aeronautical Co. or write Sam Deahl, 1004 East Park Ave., Tallahassee, Florida.

WACO F. WARNER: Licensed to July, 1936. 450 hours total, 40 since major overhaul. Ship in good condition. Has Heywood starter, steel prop, bank and turn rate or climb, air speed, compass, navigation lights. Price, $1,495. Louis Egger, Woodsfield, Ohio.

TANK ROBIN: 170 hours on new motor and ship since complete recovering; Fahlin propeller. Remarkable performance; sometimes used as demonstrator by Tank factory. Lights, battery, all instruments. Always hangared, never cracked. Licensed to August 1936. $900 cash. Edward H. Berg, 2046 S. 79th St., West Allis, Wisconsin.

EAGLEROCK, HISSO A 150 h.p.: Excellent condition, duals, brakes, clock, compass. Highest cash offer, or trade on smaller ship, 65-110 h.p. Charles Farmer, Eden, New York.

PITCAIRN PA-6: Excellent condition; fabric one year old; full airwheels; Curtiss-Reed metal prop, recently reconditioned; motor has 75 hours since major; fine ship for passengers, freighting, dusting, banner towing; navigation lights, compass, flare brackets; will sell for $900 cash or trade for Aeronca or Cub and pay cash difference G. M. Downs, Ann Arbor, Michigan.

WACO CJC: 250 Wright; relicensed January 15th; 100 gallon tanks, radio, night flight equipment, flaps, etc. 200 hours ship and motor. Available Chicago February 10. AERO DIGEST, Box 2235.

24 FAIRCHILD: 2-place, 125 Warner. Latest 2-place, built February. 1934; less than 200 hours; never damaged. Company executive private ship. Up for relicense this month. Equipped storage battery, rate of climb, turn and bank, sensitive altimeter, Heywood starter; color, black. Will include radio, not installed. Immediate sale, $2,400; terms responsible person. Master Builders, Chandler Building, Washington, D. C.

FOR SALE: Licensed Curtiss Challenger Robin, 185 h.p. In excellent condition. $1,000. C. R. Fritschle, 7700 Country Club Court, St. Louis, Missouri.

CHALLENGER ROBIN: Excellent condition. Hamilton propeller, tail wheel, starter, cruises 105 at 1600. $950. Stafford Flying Service, Box 218, Stafford Springs, Connecticut.

Deadline

for

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Advertising

MARCH ISSUE—

February 19th

WARNER CESSNA, KR-31: Ships best of condition, licensed; either for sale or trade on Master Aeronca or Waco F. Ken Barber, Route 4, Pontiac, Michigan.

VELIE MONOCOUPE: Licensed until June, 1936. Always hangared. Fabric good. Oleo type landing gear. Asking $550. For information, write F. J. Nealer, General Delivery, Indiana, Pennsylvania.

SELL OR TRADE: Ryan B-5 J6-9 six-place Brougham. Total time 290 hours; motor majored, modernized; starter, Hamilton steel prop, duals, brakes, night flying equipment, new aluminum tanks, new air tail and landing wheels. Ship recovered, refinished, silver and red, November, 1935. Licensed to November, 1936. Cash, $2,475. Trade for Cessna C-34, like condition. Paul Foust, Huntington, Indiana.

DE LUXE DAVIS: LeBlond 70, oleos, air wheels, new fabric; licensed; $850. Will trade for Cub or Aeronca. 6000 Travel Air, modernized J6-9, new fabric; licensed January, 1937, $2,500. Iowa Airways, Fort Dodge, Iowa.

AIRCRAFT BARGAINS: Lambert Monocoupe with factory reconditioned motor; Hess-Warrior Argo; Salmson powered American Eaglet, just rebuilt; Taylor Cub demonstrator with very little time. Write for further particulars. Airport, Natick, Massachusetts.

WACO GXE: Tank-conversion OX-5 98 h.p. 2 German Bosch mags. 200 hours, never cracked, always hangared. Recently recovered; ivory with red trim, Lockheed style. Dual instruments, safety instruction stick. Spare prop. Licensed to July. $525. Consider trade for Curtiss Jr. and cash. Pilot, 811 W. Dayton, Madison, Wisconsin.

WACO 10 GXE: Motor just majored. New connecting rods, carburetor and magneto, $450. Trade for Stearman, Waco F or Taperwing with additional cash. William Picune, 743-34th Street, North Bergen, New Jersey.

KELLETT AUTOGIRO: Model K-4. Total time, 550 hours; 111 hours since major overhaul and modernization. This ship is in perfect condition and fully equipped. Price, $2,300. Licon Airways, Incorporated, Islip, New York.

J-5 LAIRD: $1,095. Taylor Cub, A-40-2, $865. 4-place B-5 Bird, recovered, fully equipped new instruments, radio, landing lights, $2,100. Wanted: J-5 main crankcase. Indiana Air Service, South Bend, Indiana.

KINNER ENGINE: One 160 h.p. R-5, 235 hours total and 147 hours since major overhaul, including special copper lead bearings; engine is late type; no reasonable offer will be refused. AERO DIGEST, Box 2240.

REPOSSESSED AIRPLANES: New Taylor Cub; Wallace 3-place Kinner cabin monoplane; American Eagle, late Kinner 100 h.p. 3-place biplane; and Kinner B-5 autogiro, $300 down. Buhl Pup, $200 down. Balance, easy monthly payments. Write us down and monthly payments you can make. Aviation Finance Co., Hemlock, New York.

FAIRCHILD 22: Rover. Excellent condition. Licensed October, 1936. $1,000. F. C V., 857 East Luzerne Street, Philadelphia, Pennsylvania.

FOR SALE: Siemens-Halske 9-cylinder 128 horsepower engine with Hamilton adjustable propeller and speed ring. Want J-5 engine. Lawrence Hughes, Brady, Texas.

TRAVEL AIR SPORTSMAN 16K: Kinner B-5 125 h.p. 85 hours since major. Engine speed ring, steel propeller, etc. High gloss finish; wings red, fuselage black. $1,550. Foster A. Lane, Port Columbus, Columbus, Ohio.

"PIONEER" OFFERS AERONCA 2-place with E-113. Plane recovered last July, motor majored in October. Price only $750. Terms arranged. Pioneer Aviation Company, Airport, Syracuse, N. Y.

"PIONEER" OFFERS VELIE Monocoupe: Cabin, 2-place, dual controls, motor recently overhauled; has new propeller; price only $400. Terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

"PIONEER" OFFERS CURTISS JR.: Has NC license; just completely majored, overhauled, wonderful condition. Plane recovered last year. $395. Flyaway "Pioneer" Aviation, Airport, Syracuse, N. Y.

"PIONEER" OFFERS J6-5 STINSON cabin: Air starter, steel propeller, rate of climb, wonderful condition; late modernized Wright. $1,000, terms. Will trade. "Pioneer" Aviation; Airport, Syracuse, N. Y.

"PIONEER" OFFERS Lycoming Stinson: $1 100. Waco C, $2,200. J-5 Travel Air Speedwing, $1,250. Kinner Eagle, $885. Waco F, $1,500. 1934 Monocoupe, $2,000. Terms. Pioneer Aviation, Airport, Syracuse, New York.

PIONEER OFFERS RELIABLE service to airplane buyers and plane owners. If you want to sell, buy or have airplane financed, write Pioneer Aviation, care Airport, Syracuse, New York.

LYCOMING STINSON SM8A: My personal plane, in excellent condition, will be sold to best cash offer received in next thirty days. W. H. Curtis, 1414 Glendale Ave., Dayton, Ohio.

FOR SALE: Complete Lycoming R-680 radio shielding harness, including Breeze plug caps and magneto covers. All in good condition. Price, $50. E. F. Dutro, So. 5th St., Zanesville, Ohio.

WACO UKC De Luxe Demonstrator: Perfect condition throughout; special gray and blue rubbed finish. Sensitive Kollsman altimeter, turn and bank, Pioneer clock; pants, wing root streamlining, other extras. Wired for landing lights and flares 350 hours. Cost over $6,000 new. Also J-5 motor and metal propeller. (Propeller just reconditioned by Ford Motor Company). Michigan Aeronautical Corporation, Ypsilanti Airport, Ypsilanti, Michigan.

WACO 10: No time since completely rebuilt and recovered; new condition in every way. Priced for quick sale. Charley Raudabaugh, 13210 French Road, Detroit, Michigan.

CHALLENGER KR-31: OXX-6 engine. Licensed until September 1, 1936. Plane and engine completely rebuilt, in like-new condition. Less than 40 hours time since. Price, $545. Lester J. Sipe, Box 118, York, Pennsylvania.

ENGLISH CIRRUS MARK III engines: Completely rebuilt, ready to install and run, $175. Practically new approved propeller for same, $25. Complete stock of parts including magnetos and carburetors. Lester J. Sipe, Box 116, York, Pennsylvania.

● PLANES and ENGINES FOR SALE

FOR SALE: C-3 Aeronca, with winter enclosure; lights and starter. Ship is in excellent condition and priced right. AERO DIGEST, Box 2198.

WACO C: New December 1932. Leather upholstery, ambulance equipment, $2,300. Waco F, Warner $1,275. Five-place New Standard, J6-7 motor, $1,650. Taylor Cub, new September 1934, $875. All licensed. Clayton Lemon, P. O. Box 2144, Roanoke, Virginia.

AERONCA single-place: Wings, tail surfaces recovered. New prop, pistons, cylinders, valves. Licensed January, 1937. $325. Six-place J-5 Stinson, recovered one year. Licensed November, 1936. Sacrifice, $825. Trade for Taylor Cub. Good J-5 motor, steel prop. $325. Consider trades on light ships. Moody & Parrish, 825 N. Division, Decatur, Illinois.

TAYLOR CUB: Continental; just relicensed $625. Travel Air Sport Trainer, Wright Gipsy, $925. Consider late car or plane in trade. Wright Gipsy parts. J. W. Lytle, 2333 Vodeli Street, Pittsburgh, Pennsylvania.

J6-7 TRAVEL AIR: Recently majored. Speed ring, air wheels, brakes. Licensed November. $1,375. J6-7 Waco cabin, de luxe: 200 hours total; ship and engine like new; blind flying, radio, flares; cross country tanks; cruises 140; $5,750. Curtiss Fledgling: 100 hours since major; engine, fabric A-1 condition; licensed November; $975. Braman-Johnson Flying Service, Inc., East Tower, Hangar B, Roosevelt Field, Mineola, New York.

1935 AERONCA: Excellent condition, cannot be told from new. Navigation lights, larger airwheels, dual gas throttles, heater. Will trade on light seaplane. Can finance. $1,350. John Ahiuso, Sunbury Airport, Sunbury, Pennsylvania.

STINSON SM7B: Wasp Jr. recently majored, prop etched and tracked; radio, flares, landing lights, ring, pants, bank and turn, rate of climb, ice warning, starter, generator, etc. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

WACO F-2: Powered by Continental A-70. No time since major overhaul, airplane and engine. Rubbed finish. Steel propeller. Chromium-plated wires, etc. AERO DIGEST, Box 2230.

3 FOKKER TRIMOTORS: Equipped 3 Wasp 420 h.p. engines; ships fully equipped, each $2,100. Lockheed Orion, $9,500. Fairchild 42, $1,750. Northrop Gamma, Cyclone engine. Many other ships. Babb, 1100 Airway, Glendale, Calif.

AERONCA: 2-place, recently overhauled and recovered; oleo gear; $675. Cars or OX jobs in trade. Capitol Airport, Bladensburg, Maryland.

WACO 10 GXE: 75 hours since completely reconditioned; fuselage finished in hi-lustre blue, wings, red; engine 90 hours since new; Flottorp prop; price, $495. Waco A: Late Jacobs, no time since major; radio, bank and turn, Heywood starter, wheel pants, speed ring, yellow fuselage, green wings, excellent condition; price $2650. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO GXE: Good condition. Licensed to November, 1936. Full airwheels and brakes, Scintilla magneto; baggage compartment. Write E. Lescallut, 2934 Arunah Ave., Baltimore, Md.

WACO 10: Licensed, completely recovered and refinished. New motor installed. $385. American Eagle new OX-5 just installed, completely recovered and refinished special finish red and cream. new 30 x 5 wheels, tires and streamlines, burnished aluminum cowling; absolutely prettiest ship in the country. $585. Wanted: Late Jacobs-powered Waco F. Municipal Airport, Box 102, Lima, Ohio.

15 CERTIFIED Reconditioned Airplanes, priced to sell: J6-5 Travel Air; three J-5 Travel Airs; two J-5 Straightwing Waco's; two Driggs Skylarks, Rover powered; OX Waco; three OX Travel Airs two stressed for J-5 motor; J6-9 Stinson six-place cabin; model A-2 OX Eaglerock; Heath powered with Wright Morehouse. Sell any J-5 ship less motor. Trade in your ship or late model car. Terms if desirable. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

ENGLISH CIRRUS MARK III: 96 h.p. engine, brand new, complete in original crate as shipped from factory; $275. N. W. Perdew, Hasbrouck Heights, New Jersey.

STINSON T TRIMOTOR: Licensed till January, 1937. A-1 condition throughout; full air wheels, radio, bank and turn, rate of climb, starters; 11 passenger; real bargain at $2,100. Overhauled J-5 motors, like new, $400. OX Travel Air, $475. Kinner Bird, $975. Mulzer, Norton Field, Columbus, Ohio.

WARNER PRIVATEER AMPHIBION: Perfect engine, No. 839; no time since major. Ship completely overhauled, refinished. No corrosion. Total time 273 hours. Many extras. Sale, trade. AERO DIGEST, Box 2215.

FOR IMMEDIATE SALE: July, 1935 Aeronca, special paint job, brakes, compass, 100 hours, $1,250. J-5 Stinson, motor just majored, new type crankshaft, $850 cash. Turner Flying Service, Spartanburg, South Carolina.

FOR SALE: Hispano Travel Air. High gloss finish, red and black. Complete blind flying equipment; brakes; navigation lights. Licensed to January, 1937, $750. Congressional Airport, Rockville, Maryland.

TRAVEL AIR: J-6 330; 6000-B. Bank and turn, night flying equipment, electric starter. Relicensed October, 1936. Good condition. $1,600. Located Curtiss-Wright Airport, Baltimore, Maryland.

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PLANES and ENGINES FOR SALE

WACO: Beautiful job. Red and silver. Millerized OX-5. New air wheels. Private owner. Licensed. $550. R. Hanson, 425 W. Judson Avenue, Youngstown, Ohio.

WACO CUSTOM De Luxe Demonstrator: Jacobs powered, less 100 hours; less six months old. Like new. Beautiful finish, many extras. Cost over $7,700. Will sacrifice for quick sale. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

WACO F-3: 210 Continental; built July, 1934. 127 hours. Special paint, steel propeller, wheel pants, extra gas, electric starter, bank and turn, rate of climb, thermocoupe. Never damaged. Like new, $2,900. Waco F, new beads, $1,700. Lambert Monocoupe, $1,575. Central Aeronautical Corp., Municipal Airport, Indianapolis, Indiana.

NB-4, UNLICENSED: 3-place; 650 x 10 wheels, brakes. Warner Jr. like new, $600; no less. Ted Morris, 4915 East 15th Street, Kansas City, Missouri.

SELL OR TRADE: B-5 6-place Ryan; semi airwheels, speed ring, navigation and instrument lights; high gloss finish. Motor just majored, rear section factory modernized. 100 gallon gas tanks. Very fast. Will consider Waco or Stearman J-5 on trade. $1,850. J. O. Dockery Air Service, Municipal Airport, Clarksdale, Mississippi.

STINSON SM8A: Completely modernized. Little time since major. Complete night flying equipment. Appearance like new. Will take trade, balance cash. W. L. Burrall, Stratford Apartments, 3311 Liberty Hts. Ave., Baltimore, Maryland.

WACO F-3: Powered by Jacobs. 180 hours. Special leather upholstery. RCA radio. Wheel pants. Plated wires. Other extras. Privately owned. AERO DIGEST, Box 2231.

BELLANCA SKYROCKET: Wasp C. 220 hours; recovered 1934; new tires, radio, Wiley flares, speed ring, all blind flying instruments. Ship always owned by private family, has had beautiful care. $6,500. Just relicensed. Travel Air 6000-B: J6-9-D modernized 330 h.p. Recovered 1933; has 85 hours since major by Pacific Airmotive. Late impeller assembly, forged pistons, radio, flares, jumbo tires, all blind instruments. $2,550. Just relicensed. Mouton & Six, San Francisco Airport, San Bruno, California.

STINSON S: Lycoming engine, major overhauled, with new heavy duty crankshaft installed; ship completely reconditioned and refinished and in A-1 shape. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

1935 AERONCA MASTER: E-113-C motor; ship like new; heater; $1,295. Also 1934 and 1933 Aeronca, no time since factory major; enclosure, heater; make offer; need cash. Can finance. Leeward Flying Service, New Kensington, Pennsylvania.

SIKORSKY S-38: Two new Wasp C engines; 30 hours total time; ship just overhauled by P.A.M.; never been in salt water. $8,500. Mouton & Six, San Francisco Airport, San Bruno, Calif.

1933 AERONCA C-3: No time since factory major on motor. E-113-A motor. Enclosure, heater. Will finance. $895. Leeward Flying Service, New Kensington, Pennsylvania.

ENGINES FOR SALE: J6-5 with new steel propeller New Axelson B-7 with new propeller. Two OXX-6's. Five OX-5's. J-5 Wright with new steel propeller. Kingsville Cabinet Shop, Kingsville, Missouri.

AIRPLANES FOR SALE: Waco GXE, newly covered, slick finish; steel propeller; extra engine. Robin: Newly recovered, steel propeller; new OXX-6 with Miller overhead. Stinson Jr.: J6-5 powered ship, slightly damaged. Kingsville Cabinet Shop, Kingsville, Missouri.

TWO OX-5 Travel Airs 2000, licensed, 30 x 5 wheels; excellent condition. One has Scintilla magneto, Miller overhead, dual instruments, $400 and $475. Taylor Cub; bought September, enclosure; Continental A-40-3; $1200. B. Brockenbrough, Airport, Lumberton, North Carolina.

WANTED TO BUY OR TRADE

WANTED: Wright J6-9 engines, any condition. Babb, 1100 Airway, Glendale, California.

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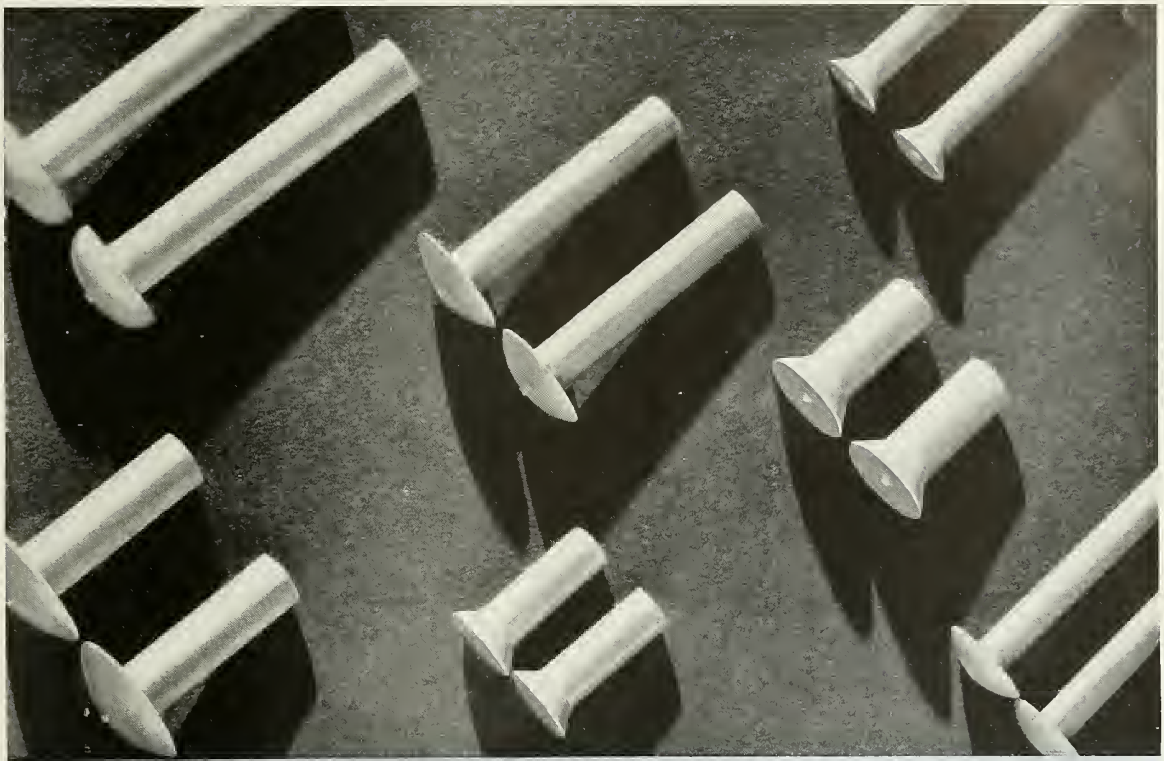

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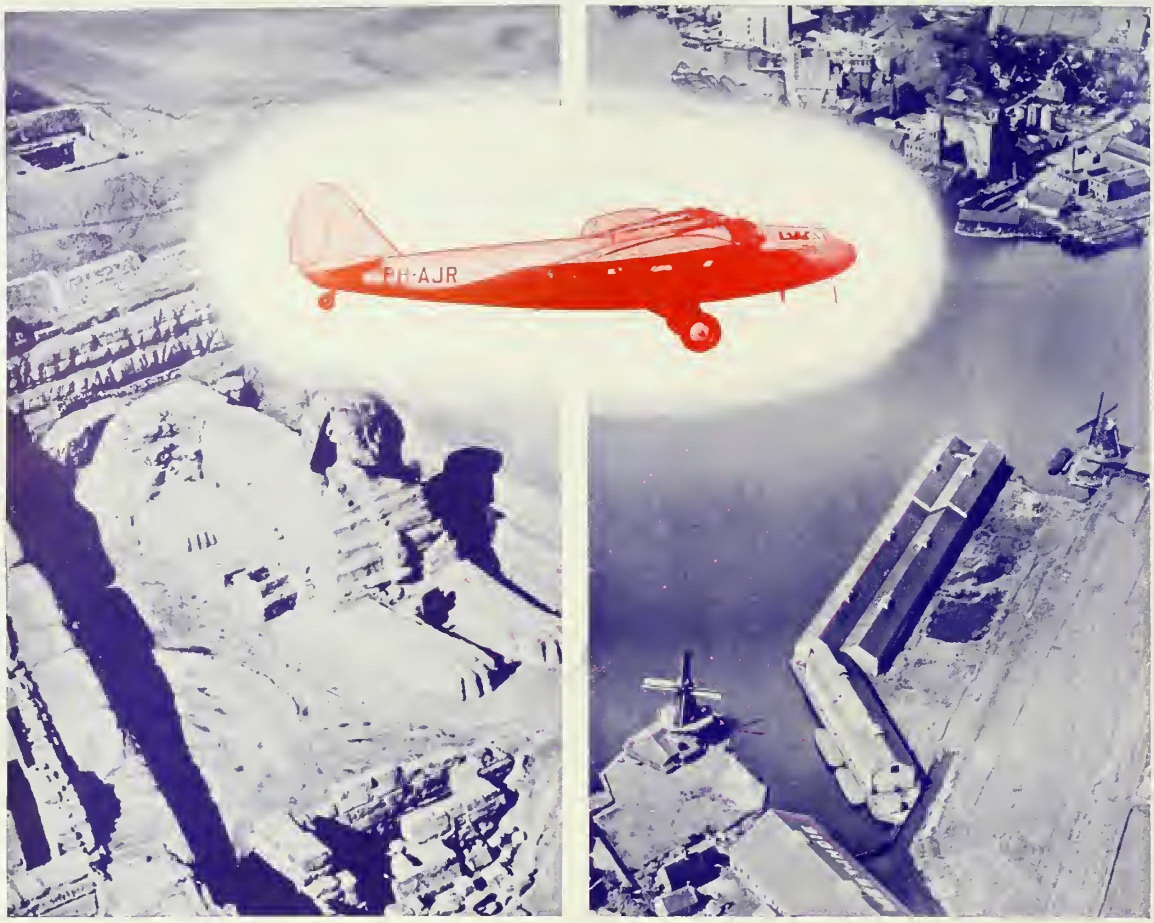

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Detailed data gladly supplied upon request.

AERO DIGEST, *March*, 1936
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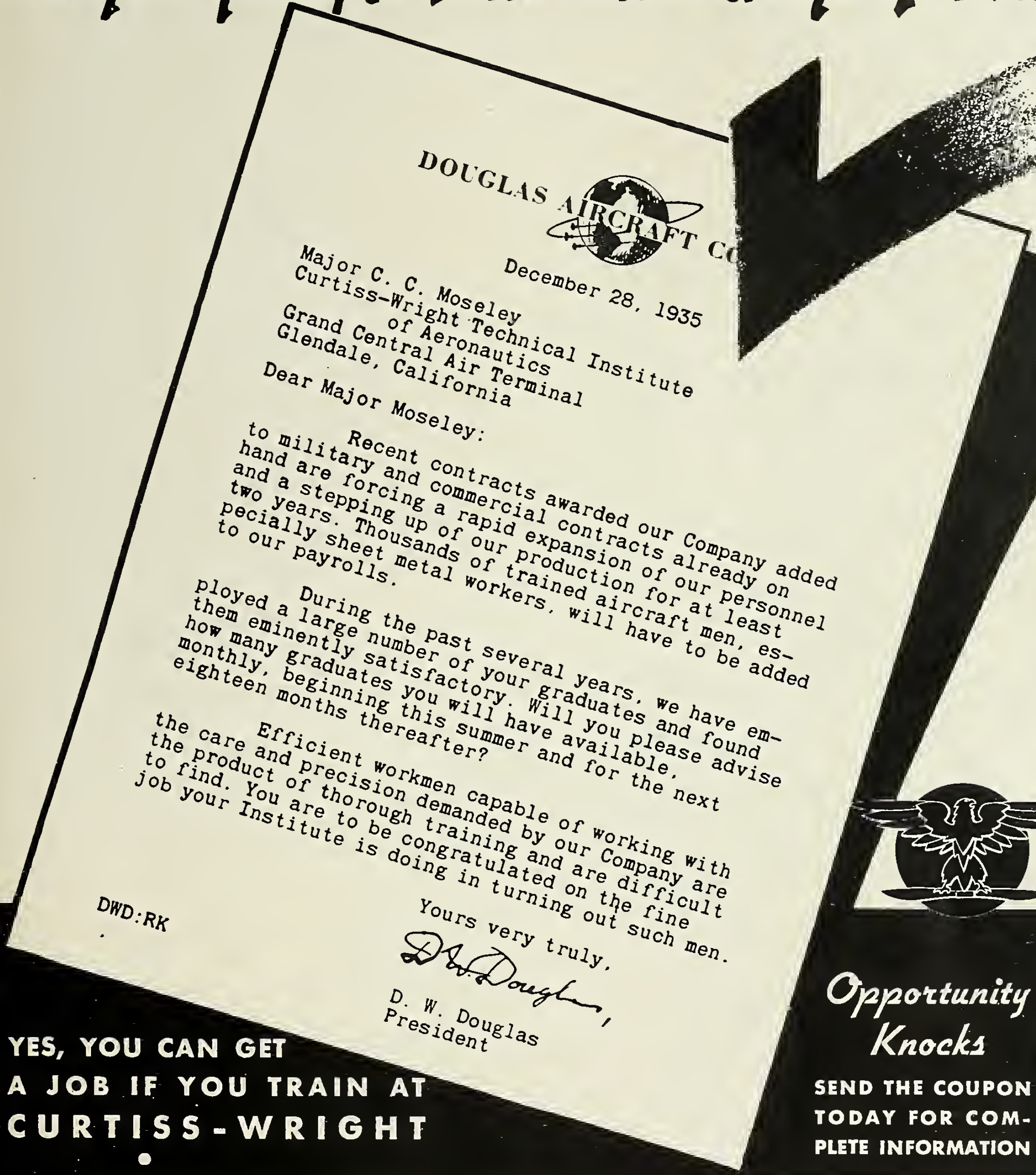

DOUGLAS AIRCRAFT C

December 28, 1935

Major C. C. Moseley
Curtiss-Wright Technical Institute
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Grand Central Air Terminal
Glendale, California

Dear Major Moseley:

Recent contracts awarded our Company added to military and commercial contracts already on hand are forcing a rapid expansion of our personnel and a stepping up of our production for at least two years. Thousands of trained aircraft men, especially sheet metal workers, will have to be added to our payrolls.

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Efficient workmen capable of working with the care and precision demanded by our Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in turning out such men.

Yours very truly,

D. W. Douglas,

D. W. Douglas
President

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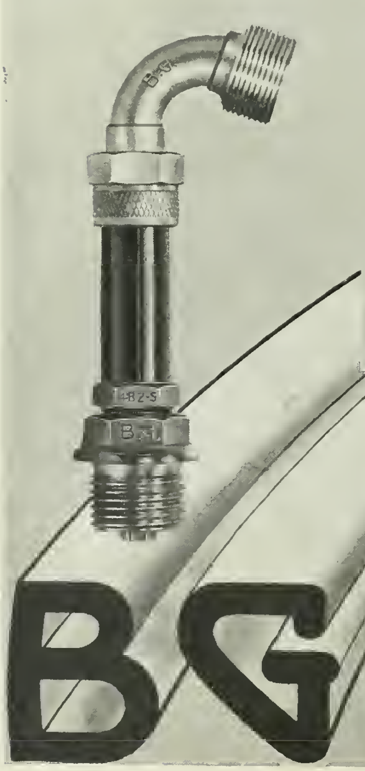

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SPECIFICATIONS

The New CUB	Type J2
Wing Span	35 ft. 2½ in.
Length overall	22 ft. 5 in.
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* * *

Power Plant	
Continental A 40-3	37 H.P.
Weight empty	563 lbs.
Useful Load	407 lbs.
Pay Load	175 lbs.
Gross Weight	970 lbs.
Power Loading per H.P.	25.5 lbs.
Maximum Speed	87 M.P.H.
Cruising Speed	70 M.P.H.
Landing Speed	30 M.P.H.
Rate of Climb	450 ft. 1st min.
Service Ceiling	12,000 ft.
Cruising Range	210 miles

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THE *New* "CUB" takes off to a new high in value . . . value that is actually built into every detail . . . value that is apparent. To see this gracefully streamlined ship is to want to fly it. And when you "take her off," you quickly discover she's faster, smoother, easier to handle and much more comfortable.

Embodied in the *New* CUB are improvements and refinements that have been developed and thoroughly tested during the past two years . . . producing an airplane that is perfectly balanced in every detail. The result? All 'round performance and maneuverability that will amaze you.

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CALIFORNIA Aircraft Associates, Municipal Airport, Long Beach, California
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LOUISIANA (S. E.) Montgomery School of Aeronautics, Montgomery Airport, Montgomery, Alabama
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NEW YORK Hylan Flying Service, Municipal Airport, Rochester, N. Y.
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In your training at Parks Air College for a career in commercial aviation you will secure a course which is at once *practical* and *comprehensive* in piloting, executive work, engineering, or maintenance, depending upon the field you elect to enter.

Practical, so that upon your graduation you can make the kind of connection you desire. *Comprehensive,* so that you can make satisfactory advancement.

But in your work at Parks Air College you will secure much more than aviation training. You will also win for yourself the same prestige which Parks Air College enjoys—prestige earned through more than eight years of constructive service in so training men that they are able to make worth while contributions to the development of commercial aviation—prestige earned by the splendid records made by these men with leading aeronautical concerns, such as:

Transcontinental and Western Air, Eastern Airlines, American Airlines, Pan American Airways, Pan American Grace, Douglas Aircraft Company, Lockheed Aircraft Corporation, Fairchild Aircraft Corporation, Consolidated Aircraft Corporation, Curtiss-Wright Airplane Company, and many others.

This prestige and appreciation is expressed by one major airline Operations Manager in this way:

> "It is impossible to overemphasize the importance of skill and dependability of personnel in airline operation.
>
> "Because of this fact and also because the certain growth of commercial aviation will require more well trained men than are now available, I want to tell you that I have a high appreciation of the work you are doing at Parks Air College. You can be sure that when we put on more men we will get in touch with you."

The General Superintendent of another major airline expressed similar appreciation this way:

> "Please be assured that we feel Parks Air College to be a source of excellent material for airline work and intend to continue to make use of your graduates in the future in various branches of our airline."

A leading aircraft manufacturer wrote:

> "We have found that any man recommended by Parks Air College is thoroughly and highly capable for the work they recommend, and always turn to them when we need additional men."

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This prestige will assist you, as it is now assisting hundreds of other graduates, in your progress in aviation.

For complete information about the opportunities offered you at Parks Air College, send for FREE Catalog. Fill in and mail coupon. It will bring the Catalog to you promptly.

The recognition and accredited standing given Parks Air College by the Superintendent of Public Instruction of the State of Illinois is indicative of its scholastic attainment in the field of higher education.

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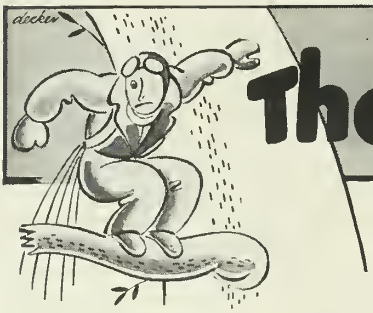


The Birdmen's Perch

Your contributions, fellows, are what make this page interesting. Keep on sending them in. We need all sorts of gossip, yarns and "believe it or not" stories —*the more the merrier.* We'll handle letters in order of arrival. Address all your correspondence to

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

DID YOU KNOW?

THAT a western pilot, after taking off, found he was sharing the cockpit with a rattler. The rattler got huffy and staged a mad attack. The pilot was bitten several times, but lived to tell the tale. —J. B. R.

That in a dog-fight during the war a flier was thrown from a plane at the top of a loop, but landed on the plane again as it completed the loop—and was saved. —S. W.

That Eastern Airlines has decided to use Gulf Aviation Gas and Gulfpride Oil in all its transport planes flying between New York-Miami, Chicago-Miami and New York-New Orleans.

BIG MOMENTS IN AVIATION

25 Years Ago:—1911—Lincoln Beachey pilots plane over Niagara Falls and flies through gorge beneath steel arch bridge.

10 Years Ago:—March, 1926—Polar Airship "Norge" completes a trial voyage between Rome and Naples with 25 aboard.

3 Months Ago:—December, 1935—Gulf Aviation products win 8 out of 9 race events, set two world records and one national record at Miami Air Races. Wherever important air events are held these days you find a sweeping majority of the fastest planes using Gulfpride Oil and Gulf Aviation Gas.

PLANE WINS FOOTBALL GAME

"Here's a wild yarn I'd like to verify.

"During a championship Eastern football game several years ago, the star back on one team found himself stranded in his home town 150 miles away.

"He'd rushed there to argue his girl out of marrying another man. He'd won the argument, but he was certainly in for a lambasting from the coach.

"Then he remembered an old friend who was a pilot. In two jerks of a lamb's tail, the star back was in the friend's plane and on his way. They reached the stadium 90 minutes later, chased the players off the field and landed.

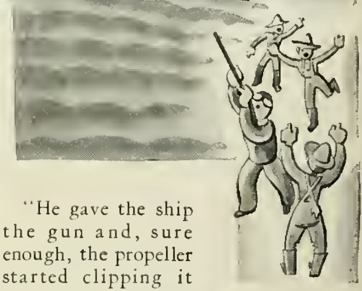
"The hero hustled into a uniform, played like a demon and made the winning touchdown in the last quarter." —W. McK.

THIS MONTH'S WHOPPER

"Hank should have known better.

"I told him when he put Gulf Aviation Gas in his tank to go easy on the throttle.

"He sailed along calm for a while after the take-off. Then he started thinking about that girl he was going to meet in Chicago, I guess, and lost his head.



"He gave the ship the gun and, sure enough, the propeller started clipping it off so fast the ship couldn't keep up with it. The propeller and the engine started tearing right out of the fuselage.

"Hank made a desperate grab for the engine, but it didn't do any good. The propeller, the engine and Hank hanging onto it pulled right away from the ship.

"Instead of coming down the three of them just keep flying in circles. Us boys figure the human thing to do is to shoot Hank the next time he circles around.

"But the farmers hereabout say they haven't seen a comet in nigh on forty years and kind of like the change.

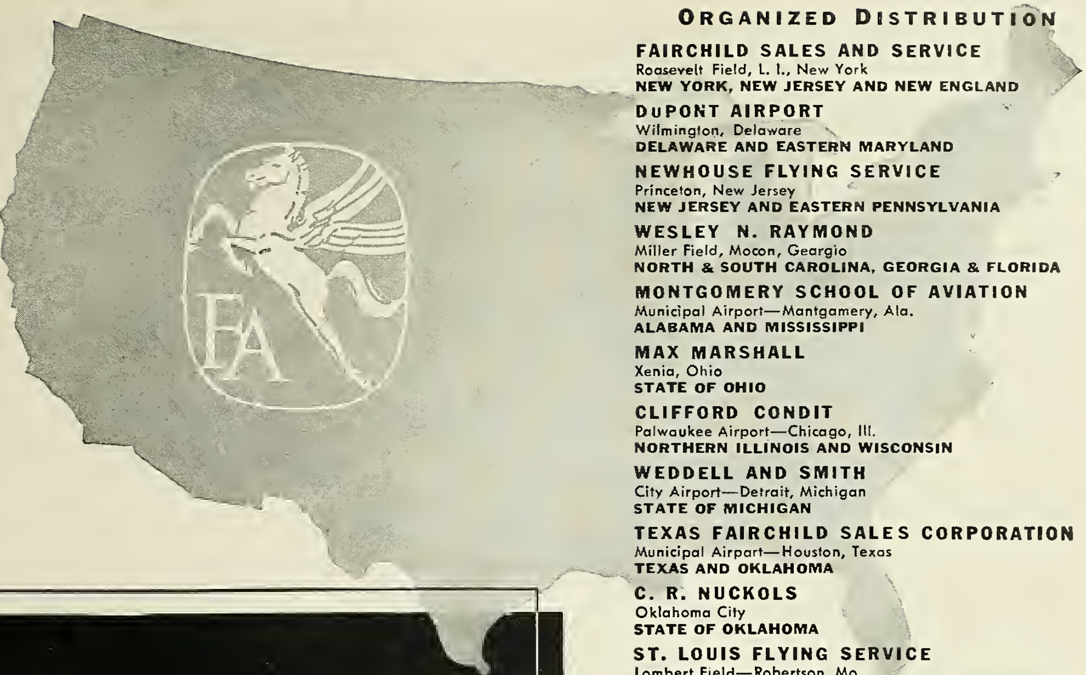
"Since Gulf's the cause of the trouble, what do *you* think ought to be done?"

BLACK MARK FOR US

We are informed in no uncertain manner that the Framingham and Natick-Wellesley Airports, Massachusetts, were omitted from the new Gulf Aviation Atlas. Our humblest apologies herewith! (But it's a swell atlas—and FREE. Write in and we will be glad to send you a copy.)

GULF AVIATION PRODUCTS

GULF



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Fairchild Aircraft Corporation, Hagerstown, Maryland, *Division of Fairchild Aviation Corporation.*

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Here Is One Aviation School That Turns Out Good Pilots . . . Expert Mechanics . . . Real Craftsmen.

12 Courses Par Excellence

In our ships and shops are 30 motors, all radial air cooled, ranging in capacity from 100 to 450 hp.

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All Types . . . 2 to 14 Place

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Complete classroom and shop instruction with all flying courses—more and better mechanical training with ALL courses.

268 Acres

as level as a floor, with hard surfaced runways, elaborate lighting system, all commercial airport facilities—that's Love Field!

Our plant consists of five hangars, 11 shops and laboratories, five classrooms, five dormitories, and cafe. We *have* what we advertise!

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We are anxious to place full details of our school before you. Our NEW TEXAS CENTENNIAL 1936 SPRING CATALOG is just off the press. Full and complete information is given covering all courses in detail. Our prices are exceedingly low. Our school is located right. Our training is second to none.

Dallas Aviation School
And Air College
LOVE FIELD DALLAS, TEXAS

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Dallas Aviation School and Air College,
Love Field, Dallas, Texas.

Gentlemen: Send the new 1935-36 Catalog and information on the course checked.

☐ Master Airman and Transport Pilots Course
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☐ Limited Commercial Pilots Course
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☐ Aircraft Instruments Course
☐ Radio Service and Repair
☐ Combined Limited Commercial and Advanced Aviation and Mechanics
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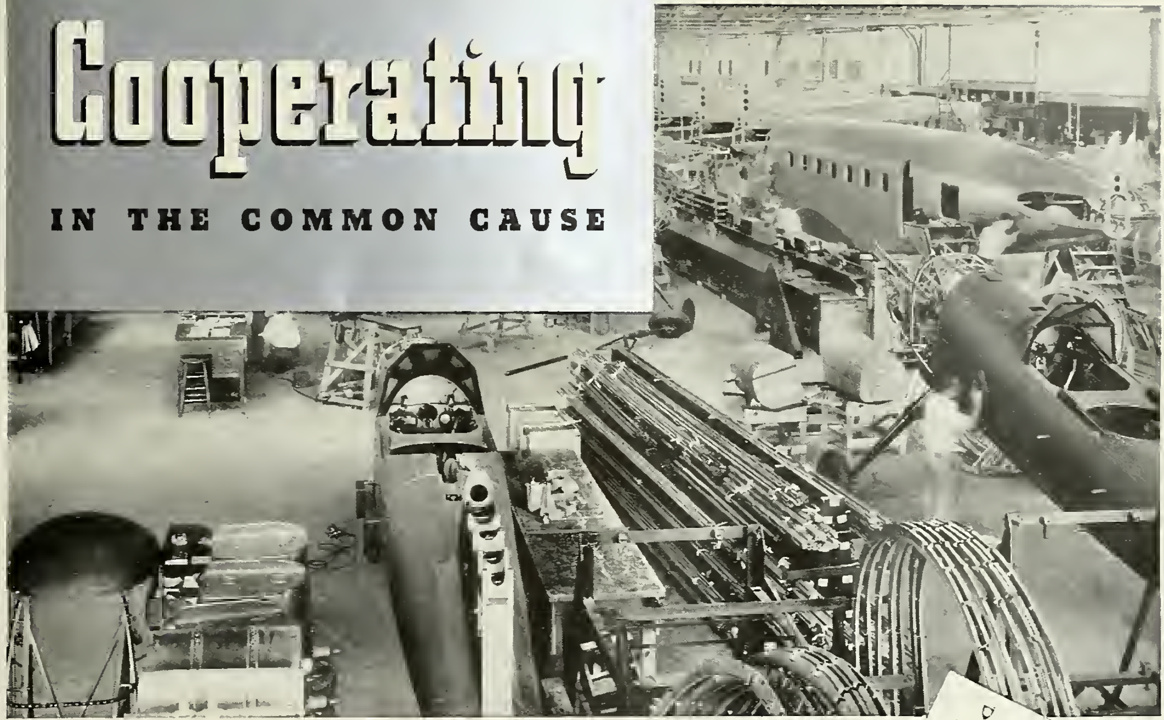

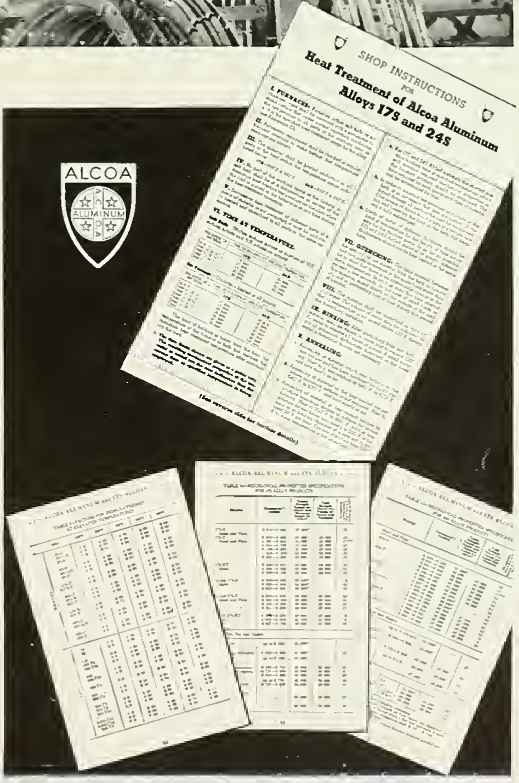

SHOP INSTRUCTIONS FOR Heat Treatment of Alcoa Aluminum Alloys 17S and 24S

Engineering, construction, and maintenance men in the aircraft industry have as common objectives: lower construction costs, cheaper and better maintenance, and safer aircraft.

On this common ground of purpose, Alcoa Aluminum engineering and Alcoa Aluminum engineers meet and serve the industry.

For example, Alcoa Aluminum engineering developed Alclad Sheet to improve the durability of construction material. Now, experience is showing that, in many instances, anodizing and priming before assembly, and also shop and maintenance painting may be eliminated when Alclad Sheet is used.

Improvement of joining methods is another field of betterment in which Alcoa Engineers have worked closely with the industry. Electric resistance welding and rivets which can be driven as received without heat treatment or refrigeration in the factory are examples.

The personal counsel of Alcoa Engineers is supplemented by instruction cards and printed technical data such as those illustrated. If you need information, why not write us. ALUMINUM COMPANY OF AMERICA, 2194 Gulf Building, Pittsburgh, Pa.

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INEVITABLE DESTINY ★

Man, with metal wings, has pierced the last frontier. Dr. Lincoln Ellsworth in his veteran Northrop, "Polar Star," has crossed the last unknown domain from the Weddell Sea to the Ross Sea. This is the final answer to the age-old question—What Lies Beyond.

★ ★ ★ ★ The Northrop Corporation, Inglewood, California.

PIONEER INSTRUMENTS

New!

Over-all depth
of Case: 3⅞ in.

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The Climb Indicator, long recognized as one of the essential instruments for "blind flying" was introduced by Pioneer in 1920. In the 15 years that followed, many thousands of these instruments have seen service with the Army, the Navy and the Airlines of the World ∗ In line with the Pioneer policy, a continuous effort has been made to improve and perfect this instrument. As the result of 15 year's experience in design and manufacture, Pioneer now offers Type 993, an entirely new Climb Indicator, incorporating the following features:

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The elimination of the vacuum bottle saves space, reduces weight and simplifies installation. Increased sensitivity and the reduction of lag make small deviations from level flight easily apparent ∗ Type 993 Climb Indicator is another of a new group of Pioneer Instruments announced this year. Others will be presented in the near future.

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Safety Developments Pioneered by STINSON

TAIL SPINS. To Edward A. Stinson, founder of this Company, goes the credit for having been first to discover how to come out of a Tail Spin. Most merciless Killer of the early days the Tail Spin had claimed scores of lives prior to Stinson's discovery. How many additional lives have been saved since that time would be impossible to estimate.

INHERENT STABILITY. To prevent the unintentional Tail Spin the first Stinson plane, in 1926, and all Stinsons since that time included the principle of Inherent Stability in their design. Not only has Inherent Stability made flying easier but it has also prevented untold scores of accidents.

WHEEL BRAKES. Brakes were first used by Stinson in the early exhibition days prior to the war. The first brakes on the wheels of a commercial production airplane were installed on the first Stinson in 1926. Without the ground control afforded by brakes the transport planes of today would not be possible. Impossible also is it to estimate the number of accidents which Stinson's brake discovery has prevented.

VACUUM FLAPS WITH SLOTS—HYDRAULIC BRAKES. No single feature in recent years has done more to increase the safety of flying than Vacuum Flaps with Slots which make possible more vertical descent, permit a plane to descend slower than a parachute and with the aid of Hydraulic Brakes to stop in a distance of 250 feet. Again Stinson was first to offer these features to the private flyer as standard equipment.

ELECTRIC STARTERS. The old method of pulling propellers through by hand claimed many lives—caused many injuries. To prevent these accidents Stinson was first to make electric starters standard equipment on its airplanes.

SAFETY GLASS. Again in 1926, in spite of its then great cost, Stinson pioneered Safety Glass which has been standard equipment since that time.

CONTROLLABLE PITCH PROPELLER. Because it makes possible quicker take off, more rapid climb and the carrying of greater loads the Controllable Propeller is playing an important role in the cause of safety. No longer is it necessary to clear obstructions on small airports by inches. Again Stinson has led by placing more Controllable Propellers in the hands of private flyers than any other commercial builder.

RUBBER MOTOR MOUNTINGS. To ward off vibration and metal fatigue; to lengthen airplane life and deaden noise, Stinson pioneered Rubber Motor Mountings in 1927 as standard equipment. This was prior to the time that the term "Floating Power" was coined and generally accepted in the Automobile Industry.

The keynote of the Stinson policy has always been SAFETY and RELIABILITY.

Apart from the desire to throw every safe-guard around human life good business has dictated this policy.

As a result, Stinson has never compromised SAFETY to meet passing fads.

Each year this policy has paid dividends in lives, in lower maintenance costs and in ever increasing public acceptance of Stinson planes as sound dependable transportation units both at home and abroad.

Private, or non-scheduled flying, was 100% safer in 1935 than in 1934, according to Department of Commerce statistics, with a fatality for approximately each million miles of flight.

During the same period the pilots and owners of Stinson planes, representing a sizable total of all airplanes in use in America, flew approximately 2,000,000 miles per fatal accident or about 100% safer than the average for all non-scheduled flying.

Believing that in the 1936 Stinson 'Reliant' we have developed an even safer and more reliable plane, we have asked the pilots and owners of Stinson planes whose good judgment and careful piloting made possible the 1935 safety record to join with us in a national campaign to further increase confidence in aviation by making 1936 the outstanding SAFETY year.

Stinson Aircraft Corp.

DIVISION OF AVIATION MANUFACTURING CORP.

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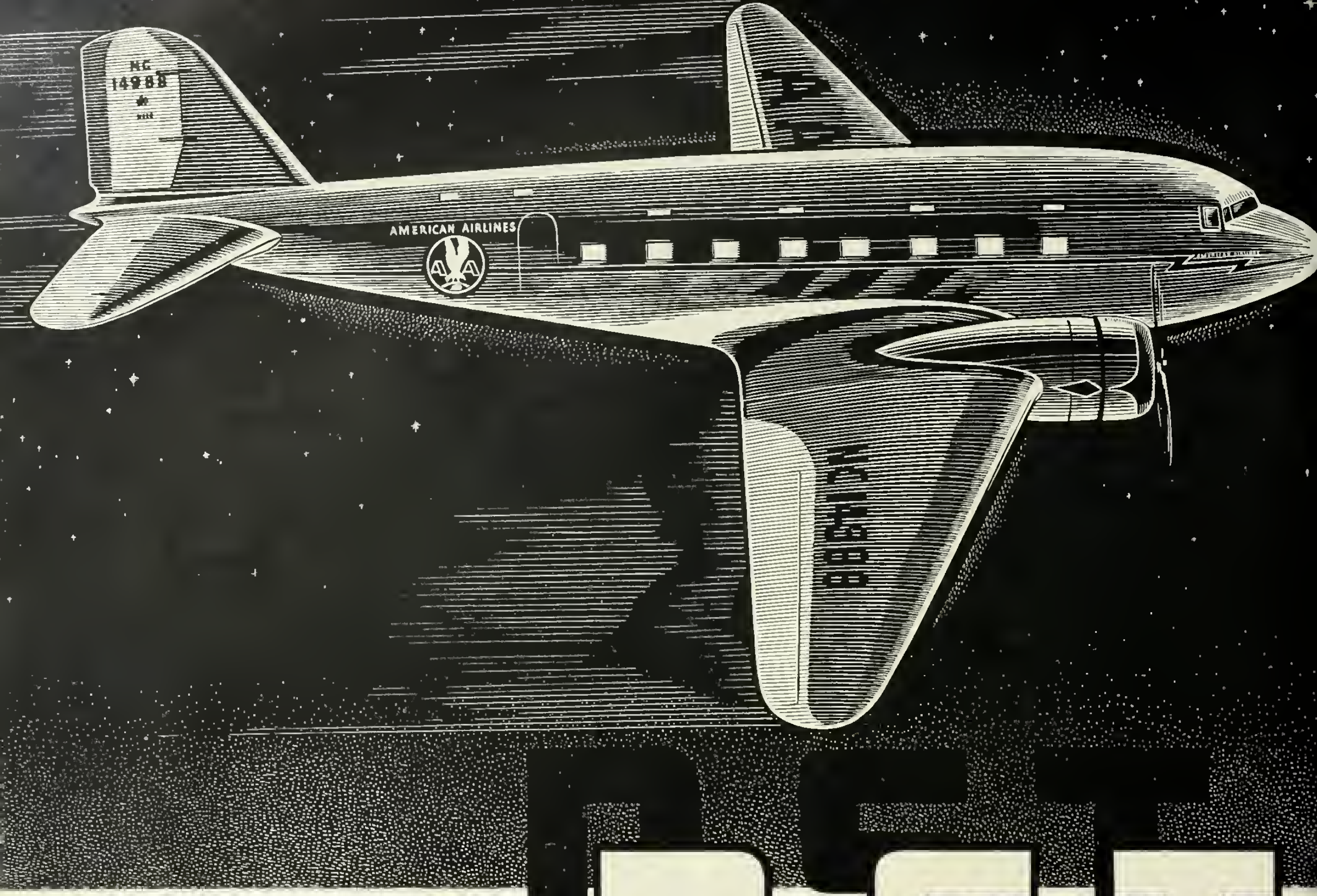

The NEW D-S-T *powered by* WRIGHT CYCLONES

Wright Cyclones have been selected to power American Airlines' fleet of giant, new Douglas Sleeper Transports. This announcement is the most important commercial aircraft engine news since the decision, two years ago, to equip the first Douglas transports with Wright Cyclones.

The Cyclone-powered Douglas is now internationally famous. Today 110 giant airliners of the DC-2 type are in operation on leading airlines in 21 countries throughout the world. They fly 75,000 miles daily—three times the circumference of the Earth at the Equator. And it is estimated that to date Cyclone-powered Douglas transports have flown the imposing total of 23,000,000 miles.

American Airlines' giant, new Douglas Sleeper Transports are royally appointed for night and day travel. The spacious cabin provides large, private sleeping compartments for 16, with day accommodations for 24—and furnishes all of the conveniences of a deluxe transcontinental train. American Airlines will soon place these luxurious transports in transcontinental service—providing direct overnight sleeper service from New York to California.

The new 1000 horsepower Wright Cyclones which have been selected to power the Douglas DST Transports are the same type as the engine which recently enabled Howard Hughes to establish a new transcontinental speed record in the phenomenal time of 9 hours and 25 minutes. The remarkably low fuel consumption of this engine supplements the low maintenance costs and reliability of the Wright Cyclone—established by 100,000,000 miles of airline operating experience.

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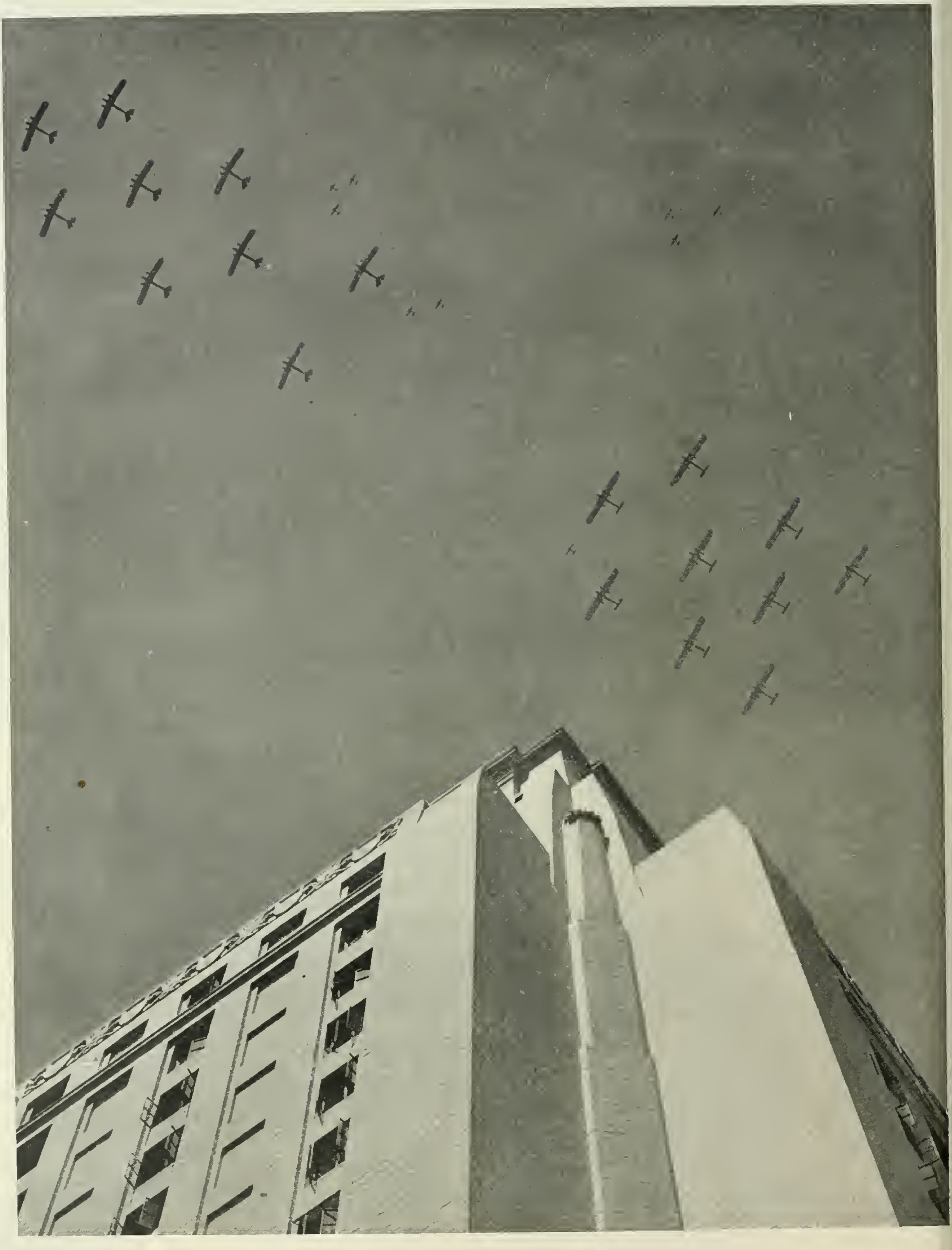


Eighteen U. S. Army bombers, protected by nine pursuit monoplanes, simulating an air raid over Los Angeles city hall

CIVIL WAR IN THE AIR CORPS

CY CALDWELL

● Although our country is at peace except for guerilla warfare between the Republicans and the so-called Democrats, (which resembles that between Ben Bernie and Walter Winchell) a small but earnestly contested war is being fought in the Air Corps. It rages over the merits of Pursuit *versus* Bombardment, and is carried on with great spirit by individual officers, irrespective of the officially accepted doctrine and the actual plans governing the probable action of our Air Force in time of war.

Meanwhile our Bombardment and Pursuit forces are suffering under two other major handicaps: We have no permanent Air Corps stations in the Eastern and Central United States from which heavy bombardment planes could operate consistently; and we have no pursuit planes capable of shooting down enemy bombers as fast and as well armed as our own Martins or the new Douglas and Boeings recently ordered for the Air Force.

The Air Force should be able to operate consistently in almost any weather. Though the weather may be bad around the airdromes, it may be fair over enemy terrain or at sea where an enemy navy is operating. We have built bombers weighing many tons, but so far we have done nothing to solve the problem of getting them into the air from Air Corps fields soaked by a couple of days' rain, although the bombardiers know that they cannot take off planes as heavily loaded as theirs from a muddy field. Due to lack of funds for runways, the Air Corps has lagged far behind commercial aviation, which uses hard-surfaced runways on nearly every airport in the country.

The old idea was that Army airplanes should be able to operate from emergency fields in wartime. But technical advances in speed, and in weight of the airplanes, have rendered the Air Corps' grass fields obsolete for anything but comparatively light and slow airplanes—and as pastures for sheep and cows.

At Mitchel and Langley Fields there are long paved servicing and warming-up aprons which, under favoring wind conditions, may be used as runways for takeoffs when the flying fields are unfit for use. But if the wind is blowing across these aprons, they will be as useless for take-offs as the rest of the field. It would seem to be common sense to use Work Relief funds to modernize our military fields so that the Air Force can use them, even after it has rained hard or when the wind is blowing from an undesirable direction. Now is the time to make these vitally necessary runway improvements, when tax money is being poured into a hundred schemes to afford work for the unemployed.

The Air Corps plans to trespass upon civil airports in time of war. This broadens the facilities available and permits the use of airports where the civil authorities have foresight enough to provide adequate paved runways for the taking off of heavily loaded airplanes. Municipalities having such fields as Floyd Bennett Field in New York, and the airports at Troy, Newark, Boston, Augusta, Me., Concord, N. H., Cleveland, Indianapolis, Port Columbus, and Sky Harbor and Curtiss-Reynolds at Chicago, have every right to demand that the Air Force modernize its own fields and consider municipal airports only in the light of emergency operational bases, to be used in wartime as infrequently as possible. Not only will military occupancy with masses of airplanes disrupt commercial transport schedules and endanger airline operations, which are vitally necessary in wartime, but the airports so used will become legitimate targets of primary importance to an enemy air force, and hence a *potential menace to cities on the outskirts of which they are situated. That the Air Force contemplates having to use municipal airports is a frank admission that their own airdrome facilities are inadequate for war.* Making them adequate now is merely buying National Defense insurance.

Exclude Municipal Airports

A really comprehensive plan for the employment of bombardment and defensive forces in war should exclude all thought of using municipal airports, except in extreme emergency, but should include the construction of war operating bases, at least so far as fields and runways are concerned, in sparsely settled areas far from centers of population.

The second major handicap under which our Air Corps suffers is that we have no pursuit planes capable of defeating modern bombers. Since our most modern type, the Boeing P-26A was designed, the following modern bombers have been built: Martin B-10 and B-12, and the new Douglas and Boeing. Compared to these the P-26 is not a modern pursuit ship. No new pursuit planes can be ordered until after the Evaluation Board at Wright Field passes upon the results of the Pursuit Competition to be held there next April. We cannot even begin to get deliveries of new pursuits until after a year has passed.

Pursuit planes, such as we have in this country to-day, will probably not be able to accomplish a great deal against bombardment in the air. However, intensive development of pursuit airplanes may result in placing this class of aviation in a better position to accomplish the mission assigned to it. It is evident that the procurement of modern bombardment planes has progressed, while the procurement of modern pursuit or defensive planes has been permitted to lag to a deplorable degree.

Meanwhile, the Pursuit *versus* Bombardment verbal war doesn't become really serious, so far as National Defense is concerned, until the partisans of one side permit their enthusiasm or their prejudice to handicap the development of one class of plane or the other. Then it is serious, for its good or ill effect.

Let us examine the matter in detail because it expresses the conflicting opinions of many Air Corps officers, some of whom undoubtedly are in a position to exert an effect upon the types of airplanes to be procured during the next few years. Nor is it sufficient to declare that such-and-such a policy is the "official" one, and that contrary opinions expressed by individual officers are merely talk, and therefore of no moment. The official policy itself is the result of the collective opinion of a great many individual officers, and individual opinions may and do affect official policy from time to time.

The opinions of a large percentage of Air Corps officers have been formed by the writings of the late General Giulio Douhet of the Royal Italian Air Force. These officers tell me that the logic of the Douhet doctrine is unassailable, so let us examine it briefly.

Wars, declares General Douhet, are fought by nations using the entirety of their resources—naval, military, industrial, and political. Without industrial support the actual fighting forces would be impotent; hence industrial centers are legitimate objects of attack. The efficacy of small-caliber rapid-fire arms has enhanced the value of the defensive; hence war on land must degenerate into a static condition where neither side can advance except at the cost of enormous losses. Even such advances are dependent on air control.

As the instruments of sea warfare remain practically unchanged, the war at sea must follow the procedure of 1914-'18 and be largely static in nature, with fleets sheltered for most of the time behind mine fields awaiting an opportunity for favorable combat that may never be afforded, or be afforded only by accident, as at Jutland. Air forces are a new menace to naval surface forces, and more effective than the submarine.

The only arm that will be able to move with a minimum of restriction is the Air Arm; this will be the only real offensive; the land and sea forces will be able only to resist. So General Douhet says: "We must group together all the forces of the nation in order to mass in that domain where the decision can be obtained—in the air. I have therefore launched the new doctrine on the principle—'Resist on the surface to mass in the air.' "

"Not a Defensive Weapon"

The airplane, says General Douhet, is an offensive, not a defensive weapon; so air power means hitting power, destruction power. It is ineffective, he continues, to seek out the enemy's airplanes in the great expanses of the sky; it is effective only to seek them out on their home grounds, and thus kill the birds in their nests. It is useless bombing soldiers in dug-outs; it is necessary to destroy the factories which supply those soldiers with their weapons. It is effective to bombard industrial and political areas and thus break down the national resistance of the people, and destroy in the mass of the population the will to wage war. Hence, to achieve this aim, *all aerial forces must be bombardment forces.* Aircraft used for defense against such bombardment forces are wasted, for they are diverted from the chief purpose of the Air Arm, which is purely offensive in tactics, though strategically it may be defensive.

Such, very briefly, is the Douhet doctrine. It has had a powerful effect upon all who have studied it—especially upon those who have accepted it without reasoning it through to its logical conclusion.

As to the effect of Douhet's thought upon contemporary airplane design, I quote E. E. Wilson, writing in the last December's issue of United States Naval Institute Proceedings on *Air Tactics and Aircraft Design*: "Aircraft are able to operate in three dimensions. They have enormous velocities and are able to employ speed and deception to such an extent that *there is no real opposition.* This means that in the war of the future, aircraft will *strike directly at industrial and military centers* behind the lines. The *possibilities of effective defense are so remote,* while *those of strong offense are so great,* that modern aircraft design is leaning *almost entirely* toward the development of offensive power." (The italics are mine.)

Now if this is so, and if nothing aeronautical can be done about it, we might as well stop trying to develop modern interceptor types, build bombers by the thousands, and study only methods of static resistance, develop bomb-proof dugouts, and gas-proof shelters, including bomb-proof underground hangars for our bombardment forces! As C. C. Furnas writes about the prospects of the human race in *The Next Hundred Years,* "We do not know what drove the dinosaurs to extinction, but on the face of it our case looks worse than theirs. However, we have one real advantage—our brains are larger. All we have to do is to use them."

But there's the rub—thinking is hard work. It is much easier to accept our thoughts ready-made than it is to analyze critically the theories of others to which we offer such ready and uncritical headroom. I hesitate to guess the percentage of Air Corps officers of all ranks who have swallowed the Douhet doctrine, hook, line and sinker: but it must be a very large percentage. I at first accepted it myself, almost without reservation, for I am convinced that an air force devised and used as Douhet envisions it must overwhelm such an air force as we have today. What I do not accept is the theory that we must be *content* with such an air force; that we must feebly sit here and be hammered at will by an enemy, while all we do in return is to hammer him where he lives.

Logic is defined as the science of correct thinking. Logically General Douhet may be right—so far as he takes us. But he takes us only to a certain point; then he turns off his logic—and stops. Let us go on from where he leaves us; let us also try to think correctly, and to think just a little further along.

Rules of Air Warfare

General Douhet defines his fundamental principle that rules air warfare as follows: *"The determination to endure the probable attacks of the enemy in order to be in a position to assemble all of one's own resources for an offensive that will be as powerful as possible. An Air Force, therefore, should not concern itself with what the enemy may do, but only with causing that enemy the greatest possible damage on his own territory."*

If General Douhet's fundamental principle is sound and if it can be carried out in practical warfare, then the doctrine is sound. If it is unsound, or sound only in theory and not in practice, then the major part of the Douhet doctrine is unsound and must fail if ever it is carried out in its entirety in a modern war.

Not to engage at this time in a discussion of tactics and weapons, let us take our first steps beyond General Douhet's last stop by reminding ourselves that military men—and I include the late General—almost invariably think in terms of military strength, not in terms of civilian weakness.

But modern wars are not fought by military force alone, but by civilian strength—*and weakness.* Therefore, the weakest point of any army, navy, or air force anywhere in the world is the undisciplined civilian force behind it.

For example, the German Army retired undefeated as a whole, an orderly and disciplined fighting force; the German Navy surrendered intact, without firing a shot after Jutland. But *civilian* Germany surrendered first—and the Army and Navy were forced to follow suit.

It is such considerations which logically seem to prove the wisdom of attacking a nation in its weakest and most vulnerable point, and which thus support the Douhet doctrine—to a certain point. *And that is reached when the civilian population of the nation subscribing to that doctrine no longer has what General Douhet describes in his fundamental principle as, "the determination to endure the probable attacks of the enemy."*

Fallacy of Douhet Doctrine

And there, I submit, lies the fallacy of the Douhet doctrine. For who, in advance of the war, can determine the will-to-resist of a nation under conditions of non-defence—a condition that no nation has yet tried upon its civilian population? Bombardment enthusiasts argue that air power offers the most effective means for quickly breaking the will-to-resist of a people—and few there are who doubt it. But meanwhile, what of the powers of patient resistance of the bombardiers' *own* civilian population, whom they plan to leave at the mercy of enemy aircraft? It is true that the will of the enemy nation to fight or resist is the thing to be broken. But how can the bombardier guarantee that the will of his own civilian population will not *first* be broken? .

Let us suppose that two equally powerful nations endorse the Douhet plan and build up tremendous offensive air forces to be directed against enemy ground targets. General Douhet says: "The sole objective of air warfare is the mastery of the air. When that is gained, the air force should be employed in attacks against terrestrial objectives in order to break the moral and material resistance of the adversary." This force consists of a mass of battle units,—heavily armed bombardment planes, and a certain number of reconnaissance units. These planes are to carry explosive, incendiary, and toxic bombs into the heart of the enemy country and thus break down, through destruction of civilian industrial, transportational, financial, and political elements, the national will-to-resist.

The war starts. Each nation despatches its powerful bombardment forces against

Curtiss A-12 Attack planes of the GHQ over New York during recent maneuvers

the enemy. The forces, we must suppose, pass each other in the air, engaging in no combat. The planes are not built for combat with each other and can not engage in combat except in defense of themselves; for their mission is not to fight other bombers, but to drop their own bombs on the enemy's airdromes, factories, wharves, railroad terminals, bridges, navy yards, munitions depots, and innumerable other targets.

As each force is seeking mastery of the air, each commander naturally will endeavor to destroy his opponent's airplanes while they are on the ground. He will send over wave after wave of his bombers, so that he will be sure to catch some of the enemy refueling, and will probably destroy many, with their hangars and shops. But as his opponent will be using the same type of weapons and approximately the same tactics, the loss of the one should off-set the loss of the other, so neither gains an advantage.

The war continues; so does the mutual bombardment. Both civilian populations, *undefended in the air,* are suffering the attacks of the enemy. Long before the armies can come to grips, long before the sea forces can engage each other, both civilian populations' "determination to endure" is weakening, as General Douhet declares that it must. The only question is—*and this is the question upon which the Douhet doctrine of all-offense-no-defense bogs down*—which population is going to give in first?

In vain the two nations' propaganda bureaus tell their respective peoples that tremendous damage has been inflicted upon the enemy. The people can *see* the damage that has been inflicted upon them; they can only *imagine* the damage suffered by the enemy. Besides, all populations are now becoming educated to disbelieve government propaganda bureaus! The people may believe or not, but they will *know* that they are *helpless and undefended victims of a policy which well may prove to have been a mistaken one.*

Civilian Disadvantage

The proponents of Douhet's doctrine are military men; they see a military advantage; but they overlook a tremendous civilian disadvantage of such a plan. If all of us, men, women, and politicians, had a fearless military outlook on life and war, we might stoutly endure bombardment, caring nothing for air defense so long as our own air forces were smiting the enemy. But we civilians, alas, are timorous folk; we expect our fighting men to defend us in time of war. It probably would occur to us that the only safe place to be in such a war would be in a bombardment airplane, hurling destruction upon a foe who was too busy hurling destruction himself to take a shot at us from another airplane.

Now, in opposition to this theory of mutual destruction and passive resistance used by both contenders, let us suppose that one side develops an air force conforming in equipment and methods of employment to the Douhet doctrine, while the opponent develops a balanced air force, part used for offense, another part used for defense. Let us suppose the forces to be of approximately equal strength in money and men and materiel—which does not mean equal in numbers of airplanes, for the balanced force will have a large number of comparatively cheap pursuit planes, while the other will have a smaller number of large, expensive bombardment planes. Let us imagine ourselves users of this balanced force, and "X", proponent of the Douhet doctrine.

At first glance, we have the bombardment power to do only half as much damage to X on his home grounds as he is able to do to us. On the other hand, partly or even largely ineffective though air defense against air bombardment may be admitted to be, we are trying to defend our people, *and they know it.* Our own bombardment air force goes off to bomb X. We have an alarm system advising people to get under cover; we have observation nets spread out to give us the earliest information of the position and probable course of the invading air force; we have balloon nets over threatened cities; we have smoke protection by our Chemical Warfare Section to hide important targets, at least partly; we have anti-aircraft protection; and we send up against X force our single-engined and twin-engined interceptor pursuits armed with .50 or larger caliber machine guns, and our multi-engined fighters equipped with 20 or 25 mm. cannon or even larger weapons. (I am supposing now a *modern* defensive force, not our present non-existent force.)

Despite such air defense, it is probable that the majority of the attackers will get through our defense screen and return safely home again. But although they have dropped their bombs and have done much damage, they have not escaped unscathed. Many bombers have been shot down; all have experienced interference in their missions; they have not had everything their own way. Their next raid will not be carried out with so much assurance; the pilots will grow more and ever more cautious as losses continue, as machine after machine fails to return. They will fly higher and higher to seek conditions where they have a greater chance to remain undiscovered.

Bombing with an Easy Mind

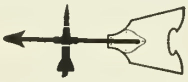
Our own bombers, on the other hand, *facing no interference from an opposing* air force, but only from ground anti-aircraft artillery, may do their bombing with an easy mind. They may hit precisely those military targets which they select, and fly calmly back and forth over their targets long enough to place a few sighting shots if they so desire, before dropping their whole load. In this way they may bomb with great accuracy. So although we have delegated to long distance bombardment only half the number of machines that X uses, our bombers not only are more effective, but have every chance of remaining in being, except for accident and chance anti-aircraft fire. Our bombardment force faces small loss, while X force must suffer much greater loss. Thus as the war progresses, we grow stronger in offensive power compared to X, who must grow weaker. Our own losses of defensive elements have no direct effect upon the strength of our bombardment force.

A policy of building an air force solely offensive in scope can be imposed only upon a people living under a civil and military dictatorship; it is unthinkable in a democracy. And even though a dictatorship may more effectively force acquiescence to such a plan, at least in its preparatory peace-time stages, the real test will come only in wartime. And it has not yet been demonstrated that people living under dictatorships have any powers of resistance superior to those of less regimented mortals living in a democracy.

United States Weather Bureau photograph showing advection fog rolling over the surface of the ocean

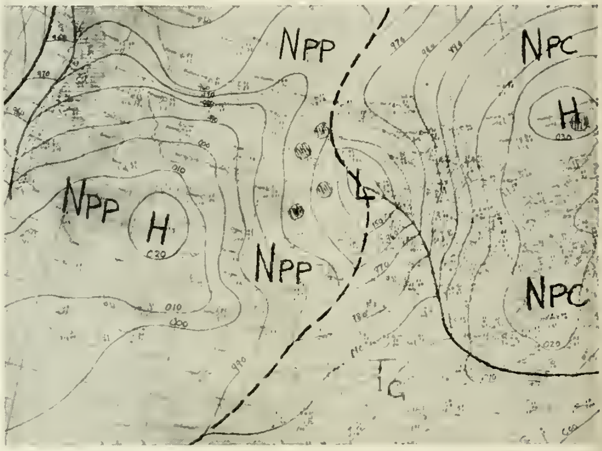
LARGE SCALE STORMS

Second of a series of articles on the subject of Flying Weather



WILLIAM H. WENSTROM

Captain, U.S.A., Meteorological Officer for
Bolling Field, D. C., and Third Corps Area



Portion of a weather map of N. America

● Most of our bad weather results from fronts and cyclones, which in turn result from the interplay of unlike air masses. This article deals largely with some of the simpler and more typical fronts and cyclones of north temperate latitudes—the general patterns on which large scale, temperate-zone storms are formed. Tropical disturbances that sometimes appear in the southeastern states are separately considered.

We have seen that large masses of air, having distinctly different properties, may move long distances over the earth's surface without greatly changing their characteristics. The general earth circulation, driven by the stupendous long-range power of the sun and evidenced by trade winds, prevailing westerlies, semi-permanent centers of high and low pressure and the like, favors the *convergence* of dissimilar air masses in certain earth regions, such as the northern Pacific Ocean and the northern and eastern United States. Most active fronts are formed in these convergence regions; but as the regions themselves move north and south with the seasons, and fronts formed in them may remain active for days as they drift elsewhere, no part of the United States is free from occasional frontal activity of some sort. In some regions, such as Southern California and Florida, the general circulation favors the *divergence* of dissimilar air masses; in these places marked fronts are infrequent.

Above the clouds over southern California

As a result of this general circulation, also, most weather in north temperate latitudes has an eastward drift (in the prevailing westerlies) averaging between 15 and 30 m.p.h. If the weather drifted eastward at constant speed in unchanged form, forecasting from telegraphic reports would be child's play. But unfortunately the speed, the direction of motion and the weather phenomena themselves are all constantly changing. In a fairly typical and much simplified case, some of these changes are sketched below.

Development of a Temperate Cyclone

Suppose that in a convergence region two dissimilar air masses—cold, dry polar continental air on the north and warm, moist tropical maritime air on the south—are coming together (figure 1a). Along the front between the two, the cold air underlies the warm air in the form of a thin wedge, and the boundary surface slopes upward and northward. The cold mass moves eastward slowly, or perhaps has a slight westward drift; the warm mass is hurrying eastward. Along the front between the two air currents a vortex tends to form, in the same way that whirlpools are formed on a much smaller scale between adjacent currents of water moving at different speeds. The first indication of its formation is a wave in the formerly straight front, taking the form shown in figure 1b. The warm current is bulging north into the cold current at the center of the diagram, while the cold current is in turn bulging south into the warm current at both sides.

The next step in the formation of this vortex is shown in figure 2, which represents a typical Bjerknes cyclone. The tongue of warm air has extended well up into the cold current, forming a warm sector. East of the warm sector there is a *warm front,* beyond which the warm air continues to rush northeastward, climbing the slowly retreating wedge of cold air. West of the warm sector is a *cold front* where a wedge of cold air, sweeping down from the northwest, is underrunning the warm air and encroaching on the warm sector. The northward rush of warm air on the east and the southward rush of cold air on the west produce between them an area of low pressure, which centers at the northern tip of the warm sector. It is indicated on a weather map by isobars, or lines of equal pressure, in the same way that a valley is indicated by contours on a a topographic map.

This area of low pressure with its approximately rotating wind system is called a cyclone (a name often incorrectly applied to the very much smaller tornado) or low. In empirical weather forecasting, the low is assumed to be the cause of bad weather. But under physical analysis, the low and its bad weather are both seen to be the result of conflicting adjacent currents of dissimilar air. The winds blow about the low generally counterclockwise. In the warm sector, they are southwest or south. East and north of the warm front, they are south or southeast or east. West of the cold front, they are west or northwest or north.

Behind the wedge-shaped cold front, the cold air mass has the shape of a shallow dome, perhaps a few miles high and several hundred miles across. Under the center of the cold dome, where the weight of cold air is greatest, there is a center of high pressure—an anticyclone or high—indicated on a weather map by isobars that resemble the topographic contours of a hill. If the high is moving rapidly southeastward behind a cold front, as many of them are, its winds are mostly northwest, and represent simply the southeastward push of one large mass of cold air. If the high is more or less stationary, however, the winds blow generally clockwise about its center. In any case, an area of high pressure on the weather map represents relatively cool air piling up overhead to considerable depth.

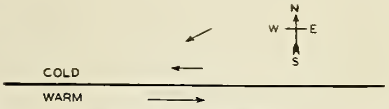


FIG. I-A ADJACENT CURRENTS

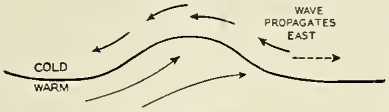


FIG. I-B WAVE FORMATION

Warm Fronts

So far we have considered only the horizontal plan view of a typical cyclone, as it appears on a weather map. A cyclone that actually occurred over the Midwest is shown in the weather map reproduced with this article. (But this actual cyclone, as will appear, is more complex than the typical case we are considering). Examining the typical cyclone of figure 2 in more detail, we note that there is a large area of clouds and rain ahead of the warm front, and a smaller area of clouds and rain along and behind the cold front. The reason for this is to be found in a vertical section through the cyclone.

The vertical structure of the warm front, along the section AA, is illustrated in figure 3. The wedge of cold air is retreating slowly. The warm, moist air is overrunning this wedge rapidly. As the warm air climbs the cold slope, it cools adiabatically, soon reaching its dew point. In the area NB, where there is still plenty of moisture in the air, it forms heavy nimbus clouds from which rain (or snow) steadily falls. (If the warm air is very moist and unstable, it may produce some heavy showers, or even thundershowers in the NB region.) As the overrunning warm air ascends higher on the slope, in the ST region, it is still saturated and condensing droplets of water; hence it forms a wide sheet of thick stratus cloud from which sprinkles light but continuous rain. As the overrunning air ascends still higher, into the AST region, it is still saturated, but has so little moisture left that it forms only a thin layer of alto-stratus cloud, with only light rain, which may evaporate before reaching the ground. In the CIST region the overrunning air is quite cold and has almost no moisture left, but is still saturated and forms a thin layer of diffuse cirro-stratus, composed of minute ice crystals. Still higher and further eastward, even this tenuous cloud thins out into mere wisps of cirrus perhaps seven miles above the surface.

To an observer on the ground, the approach of a typical warm front is signalized first by mare's tail cirrus, "locks of the approaching storm," rising out of the south or west. Then the cirrus thickens into cirro-stratus, which in turn thickens and lowers to alto-stratus. Meanwhile the surface winds are mostly from the south, southeast, or east, and the pressure is gradually falling as warmer, lighter air replaces the colder, denser air overhead. As the alto-stratus lowers and thickens into stratus, a light, continuous rain begins very gradually, and then gradually becomes heavier under lowering clouds as the warm front approaches. In the region of heavy rainfall, there may be scud clouds below the main cloud deck. After the passage of the warm front, unless there is a cold front mixed up with it or immediately behind it, the sky clears partly and the rain stops, the surface air is warmer, and the pressure remains low.

Cold Fronts

Now let us examine the vertical structure of the cold front, diagrammed along the section *BB* in figure 4 on a somewhat larger scale than the warm front in figure 3. The wedge of cold air is advancing rapidly, underrunning the warm air. In the region CUNB the warm air is being lifted most violently and cooled most

Cumulo-nimbus clouds at Cheyenne, Wyoming quickly. As a result, there are heavy cumulo-nimbus clouds here, with heavy showery rains, and perhaps thundershowers. Further back on the advancing cold wedge, in the region CU, there is still some lifting of warm air which is still quite moist and perhaps unstable. Also, the cold air mass itself may be fairly moist and unstable. As a result, cumulus clouds and scattered showers may continue for some distance behind the cold front, particularly around mountains where rising currents start the unstable air upward.

As the cold air wedge rushes southeastward, friction at the ground retards its progress in the lower levels, particularly if the ground is hilly. Hence the cold air aloft tends to bulge out ahead, perhaps twenty miles or more beyond the cold front at the ground. In this region the temperature gradient may be steep and the air distribution may be unstable, resulting in violent overturning with heavy up-and-down drafts. In the extreme case of a deep, cold wedge pushing rapidly into warm, moist air, the front may be marked by a continuous line of thunderstorms, and is called a line squall. (Incidentally, any large thunderstorm may exhibit in miniature some of the characteristics of a cold front.)

To an observer on the ground, the approach of a cold front is usually signalized by a line of heavy cumulus clouds approaching from the west or northwest, which may be preceded and partly screened by other clouds such as false cirrus and alto-cumulus. Parallel banks of alto-cumulus, particularly, are the characteristic forerunners of many cold fronts. From an airplane at high altitude the line of cumulus clouds can usually be seen better, and sometimes visibly extends for hundreds of miles. As the front approaches the pressure tends to fall gradually, becoming unsteady. The heavy clouds, often dark and threatening in appearance, continue to rise out of the west, and below them may be a gray wall of rain. The pressure begins to rise sharply as colder air arrives overhead, and the south or southwest breeze is interrupted by heavy puffs out of the west or northwest, which build up into a gusty wind that may be a gale. Meanwhile the rain (or snow) slants downward in showers that are heavy, but usually brief. Finally perhaps an hour or two after frontal passage, the showers have become lighter and less frequent, the pressure is still rising, and the clouds begin to break away. But if the cold air mass is very unstable, showers and cloudiness intermittently renewed may delay the final clearing for several hours more, particularly around and on the windward slopes of mountains.

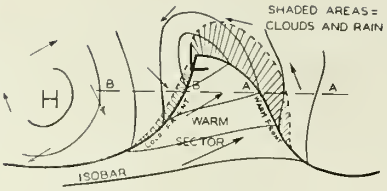


FIG.2 TYPICAL CYCLONE

Occlusions

So much for the structure of simple warm and cold fronts. As the cyclone of figure 2 continues its development, the cold front is moving faster than the warm front, and overtakes it, gradually pinching out or occluding the warm sector (this process is illustrated in figure 5a). The dotted line here represents the occlusion; that is, the combination of warm and cold fronts where the latter has overtaken the former. The occlusion itself usually extends gradually southward from the low as more and more of the warm sector is forced above the surface by the closing wedges of colder air. The northern end or tail of the occlusion may swing southward and eastward, forming a secondary cold front attended by considerable bad weather. Considered in vertical cross-section, an occluded front may take either of two general forms, depending on which of the cold air masses (on either side of the warm sector) is the colder.

Usually the cold air behind the warm sector is colder than the cold air ahead of it. After the cold front has overtaken the warm front, obliterating the warm sector at the ground, it continues to plow along the earth's surface, lifting up in turn the less cold air beyond the warm front. The section *CC* across such a cold front type occlusion (or simply cold occlusion) is shown in figure 5b. The warm sector, pinched out at the surface, exists for a time aloft. Ahead of the occluded front, on the retreating wedge of less cold air, are clouds and rain of the warm front type; along the occlusion and behind it are clouds and showers of the cold front type. Ahead of the cold occlusion the surface pressure is falling; behind it the pressure is rising.

The less frequent warm front type occlusion is shown in figure 5c. Here the air behind the warm sector is less cold than the air ahead of it. After pinching out the warm sector, this overtaking and less cold air cannot displace the wedge of colder air ahead of the warm front, but rides up on it behind the warm mass. Here again the warm sector exists for a time aloft after it is obliterated at the surface, and the cloud forms of both warm and cold fronts are combined along the warm occlusion. If the overtaking, less cold air mass is fairly warm and very moist, and if the original warm front is moving slowly (or perhaps stalled against a mountain range), the warm front rain may continue, or even increase, until a new cold front arrives from the west, deep enough and cold enough to plow under the preceding fronts and sweep them eastward as an occlusion of the cold type.

Weather Complications

It cannot be too strongly emphasized at this point that the temperate cyclones, fronts and occlusions discussed are typical models, much simplified. Rarely do the actual fronts on the weather map fall into such simple and typical forms; if they did, physical weather analysis would be easier than it is. On the weather map, for example, observe that the cold front to the southwest of the low is not a pure cold front, but an occlusion of the cold type. It occluded another warm front out over the Pacific a couple of days before, and is still carrying some of the debris in the form of preceding stratus clouds. Also, there is a secondary front southwest of the low center that has been omitted in this map for the sake of simplicity. On the Pacific Coast near Oregon, another warm front is stalled against the coastal mountains while a cold front rushes in to occlude it from the west. The resulting occlusion will probably sweep inland, piling up in clouds and rain against the higher mountain ranges and doing nothing much in the relatively flat country between them. In the East, warm fronts often bend around the Appalachians, assuming anything but typical shapes. Fronts are often so mild they can scarcely be recognized, and even if characterized by plenty of wind and weather, they may be diffused over a zone a hundred miles or more wide. A front may appear to fade for a time, then regenerate into an active disturbance. One front may tread on the heels of another so that the cloud forms are badly confused. The daily effect of solar heating and radiational cooling must also be considered: fog and lower clouds tend to burn off during the morning, cumulus clouds tend to build up in the afternoon; clouds tend to lower

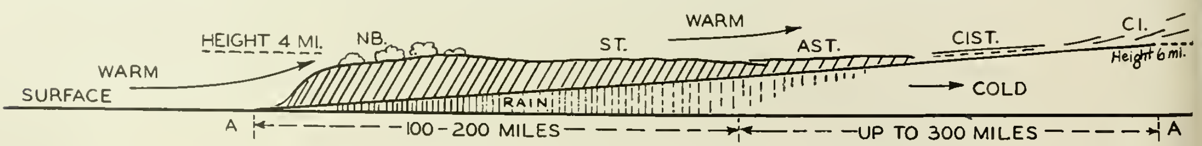


FIG.3 VERTICAL STRUCTURE OF A WARM FRONT

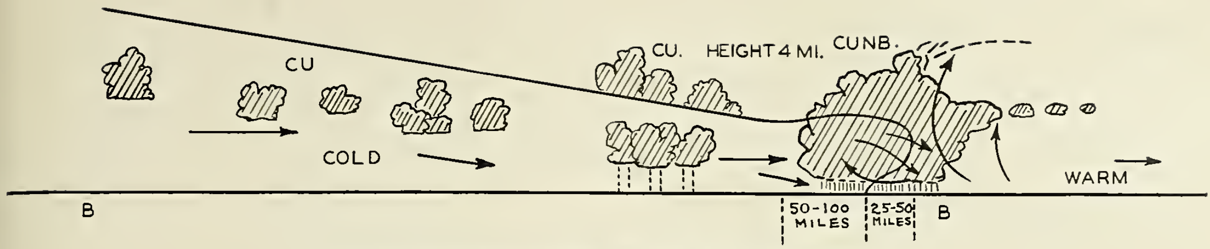


FIG. 4 VERTICAL STRUCTURE OF A COLD FRONT

and fog tends to form during the night. All these vagaries combine to make the conscientious forcaster's task anything but easy, despite all the aids of air-mass-and-front analysis.

Flying Conditions in Warm and Cold Fronts

Flying through or near marked frontal, storm or fog conditions is never advisable unless the ship is inherently stable and easily controllable, unless it is completely equipped with dependable blind flying instruments (including an outside thermometer), and unless it carries a dependable radio (which should preferably include a transmitter as well as a receiver). If all these conditions are met, many bad-weather situations offer no serious difficulties.

Barring icing conditions and occasional thunderstorms in tropical maritime air, warm fronts can be flown through with comparative ease unless a landing becomes necessary near the front itself. The front usually extends from northwest to southeast or east, and moves slowly northeastward or northward. In the immediate frontal zone, perhaps a hundred miles or so wide, the lowering clouds may be close to the ground or even on it, the rain moderate but continuous, and the visibility poor. Ahead of the frontal zone, the ceilings are higher though lowering gradually, and the rain is lighter. Well behind the frontal zone the weather is usually good unless conditions favor an advection fog, or a cold front is closing in.

Crossing the warm frontal zone usually involves a fairly long stretch of instrument flying; but this is not difficult with suitable equipment, as the air distribution is usually stable, and turbulence is consequently slight. With good radio contact, terminal conditions can be frequently noted. They are not likely to change quickly. If the warm sector is clear, it will probably remain so. Two or three hundred miles ahead of the front, ceilings are probably ample and will lower but slowly.

The chief difference between warm and cold fronts from the flying viewpoint is that warm front conditions are relatively slow-changing and stable, while cold front conditions are relatively quick-changing and unstable.

Individual cold fronts vary widely. If the temperature and moisture contrasts between the displaced warm air and the displacing cold air are large, if the front is moving rapidly, and if the winds ahead of it and behind it are high and sharply contrasted in direction, the turbulence, clouds, showers and other effects will be correspondingly violent. On the weather map such a front is marked by a deep pressure trough; the isobars are close together, and they make a sharp V-shaped bend where they cross the front. The extreme case, occurring but rarely, is a line squall marked by a continuous line of thunderstorms.

Although ordinary cold fronts and cold occlusions fall short of line-squall intensity, they may be accompanied by unfavorable flying conditions. The front usually extends several hundred miles from southwest to northeast, and the entire line advances steadily southeastward or eastward at a speed perhaps between 15 and 40 m. p. h. Along the front there are often heavy showers in which ceiling and visibility may drop suddenly to dangerous values. Above, the heavy cumulus clouds are turbulent enough to make instrument flying difficult and uncertain. Icing is frequent in the colder seasons, and may be severe.

When a violent cold front is approaching a flying field, airplanes should usually be grounded for a time. Within an hour or so after the frontal passage, conditions improve; first westward, and later eastward as the front and its bad weather zone move on. A pilot meeting a violent cold front on a westward flight should find a suitable landing place, giving way eastward if necessary, land, and proceed westward after frontal passage. A pilot overtaking a cold front on an eastward flight, having a better chance to test its intensity gradually, can proceed with caution, returning towards the clearing west if necessary.

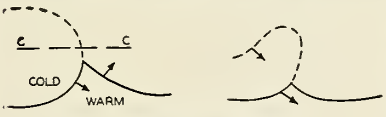


FIG.5-A THE OCCLUSION PROCESS

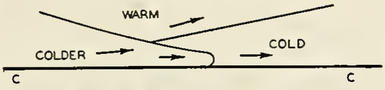


FIG. 5-B VERTICAL SECTION OF A COLD OCCLUSION

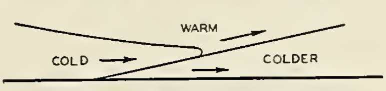


FIG. 5-C VERTICAL SECTION OF A WARM OCCLUSION

Tropical Hurricanes

In the tropics marked fronts are rare, and the inhabitants enjoy air mass weather most of the time. In the West Indies, for example, only one kind of air (tropical maritime) is normally present, and the rainy season, marked by frequent thundershowers and squalls, occurs in the summer when this air is warmest and moistest under the vertical rays of the sun. But the West Indies are occasionally visited by violent storms, which sometimes invade the southeastern United States. These are the tropical cyclones or hurricanes.

In summer and early fall the calm doldrums north of the equator steam under the sun's heat, and their moist, unstable air continually builds up into towering thunderstorms. If the rising currents happen to extend over a fairly large area at one time, the latent heat released by large-scale condensation may cause a local drop in atmosphere pressure, which in turn induces an inward flow of warm, moist air. Swayed by the earth's rotation, these inflowing currents soon assume a spiral or circular form.

The result is a destructive hurricane, driven by the gigantic energy of latent heat released in the wholesale condensation of water vapor. The great air whirl, which may be two or three hundred miles in diameter, is truly circular in structure; and as it is all included in one tropical maritime air mass, it has no fronts in the ordinary sense. But the circular winds blow counter-clockwise about the center at terrific speeds, sometimes as high as 120 m. p. h. or more. And the hurricane area is marked by a dense pall of cloud and torrential rains, except in the relatively calm central eye. The formation usually moves slowly northward, first drifting west in the trade winds and then veering east in the prevailing westerlies.

Flying conditions in tropical hurricanes are extremely poor. But their progress can now be continuously charted, and their probable future motion predicted hours or days in advance.

Prospects Records

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LEWIS CRUIKSHANK

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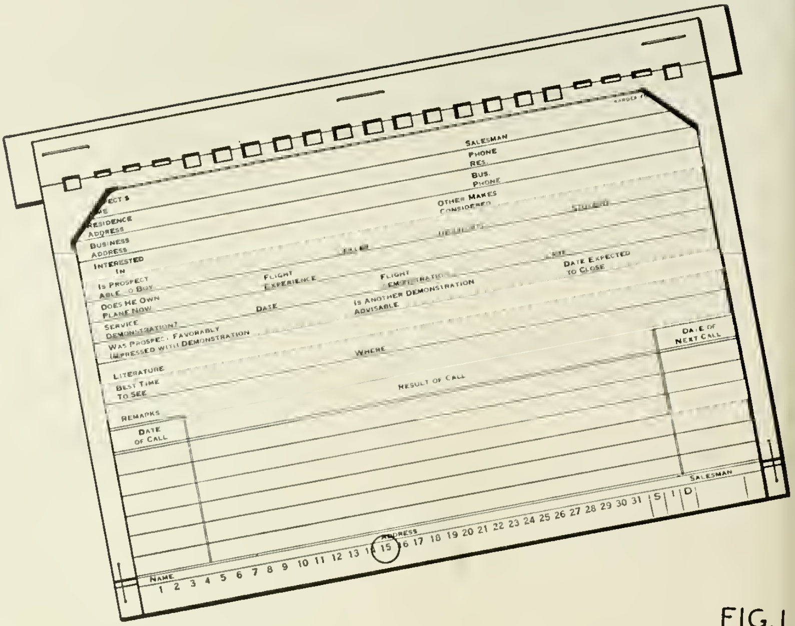


FIG. 1

In preparing these articles on record keeping, the author was confronted with the problem of discussing forms and plans which could be used by the average aviation company. Realizing that the systems presented cannot be applied to every need, he will answer questions on this subject without charge. Queries on problems in record keeping addressed to the editor of AERO DIGEST will be answered by Mr. Cruikshank.

● Records have always been a business necessity and some of the earliest documents known were records of commercial transactions. The symbol writing of the primitive man, who chiseled or painted inscriptions on the walls of his home and his meeting places, was prompted by the need for making some form of record of verbal agreements. The urge to create the alphabet and to form words came to the Phoenicians.

From the first records of man, down through the years to the present day, the constant development and improvement in records and record-keeping methods have gone hand-in-hand with the development of business. As each new business era dawned, the methods of its predecessors gave way to more effective procedures. Each improvement in record-keeping methods increased the value of the records, which in turn have hastened the arrival of the next business era.

In recent years business cycles have changed rapidly, some over-night. Twenty years ago the automobile industry was in its infancy, and ten years ago the radio industry had scarcely been born. Today through man's inventive genius; through improved communication and transportation, and through present-day methods of production and merchandising, fifty per cent of the families in the United States own automobiles and the radio is most universally enjoyed. Modern business requires modern business methods if it is to retain its position. Fifty years ago the loose-leaf record and the now common vertical card system were new, untried and considered radical. Yet, for many business records both have been succeeded in a remarkably short time by the visible record. The record methods and procedures of fifty, twenty and ten years ago, have been supplanted by the methods of present-day business, and the business man who has failed to keep pace with the world's progress has found himself left by the wayside. It is the purpose of this article to indicate a few of the more important record-keeping methods and procedures which have made modern business possible.

Value of Records

Today, records are considered to be one of the few intangible assets of the modern business. They are intangible from the standpoint of their dollars and cents value because their values cannot be measured in dollars and cents, and yet, they are usually the only irreplaceable asset of the business. If a factory is destroyed, another may be built; if customers are lost, others can be gained; but when records are lost they can never be replaced.

Proper records alone do not assure business success, but they furnish accurately and quickly, and to a large extent automatically, the facts upon which a capable executive can build a solid business structure, and without which no temporary success can long be maintained.

Not so many years ago the most serious business problem was the cost of production. In face of high production costs, profits were uncertain. Something had to be done about it. The efficient minds that tackled that problem have solved it within a comparatively short time. It is interesting to note how this was made possible, as it points the way to the solution of a similar problem of equal importance which faces the business man of today. In the first place, they cut waste motion and reduced production costs by analyzing each factor of the problem and working upon it individually. They studied one method or one machine at a time and approved it or improved it. When they were finished, the combination of these individual improvements produced the desired results.

Reducing Selling Costs

A serious problem of the present day is the high cost of sales. While production costs have been coming down, the cost of selling has been going up, and so business in general is but little better off. Profits are still uncertain, in fact, the Department of Commerce reports that only a small percentage of business organizations report any appreciable percentage of profits. Yet, these conditions are not as hopeless as they appear at first thought.

There is a way to satisfactorily reduce sales cost and increase profits through methods which have been recognized for many years by that small percentage of business concerns which are regularly producing and paying dividends to their owners and stockholders. These methods, based on a procedure similar to the one found so effective in reducing production costs, include the study and analysis of each factor which contributes toward the high cost of selling, and the elimination of each part of the problem individually.

Many factors enter into a discussion of selling costs, including nearly every phase of marketing, advertising and selling. No formula can be applied generally as each factor of its sales cost can point the way to a reduction in these costs and an increase in profits. It is not the purpose of this article to discuss these factors at length, as all of them do not pertain directly to operating business records, and cannot be said to have a common place in all business organizations.

The Prospect Record

One outstanding factor plays a most important part in reducing sales expense wherever salesmen are employed. This is the maintenance of an adequate prospect record, for without prospects (one who both needs and has the money for your product) there can be no sales.

Frequently the prospect's need is not apparent until it is discovered by the salesman and demonstrated to him. This is especially true of the more specialized and intricate product, as the prospect cannot appreciate the usefulness and merit of an article of which he has never heard until he has been shown how it will be of value to him.

It is equally true that the sale cannot be made, despite the usefulness of the product, unless the purchaser has the money or the means to procure the money with which to pay for the article.

The classification of an individual as a "prospect" or as "no prospect" is of fundamental importance and should be made as soon as possible after the salesman's first call.

Every call made by a salesman has a definite cost. It requires a certain amount of time and regardless of whether the salesman is on salary or commission, each call costs his employer either time or money or both. Calls wasted on individuals who cannot be truly classified as prospects, although they may be interested, decrease the salesmen's effectiveness and increase the cost of sales.

Analyzing Sales Effort

Maintenance of a prospect record brings these wasted calls to the immediate attention of the management, and speedily corrects this fault in the new salesman before his condition becomes chronic and before the salesman becomes discouraged and resigns. Without such a record the management would be unable to analyze this and other weaknesses.

After the salesman and management agree that the party is truly a prospect, the adequate prospect record conserves the salesman's time by directing his efforts in the various steps of the sale which have proved most successful through past experience. The salesman is therefore saved much effort and the final closing of the sale is made possible without unnecessary calls and unnecessary expense, through a predetermined plan. Frequent references have been made to an adequate prospect record. Many organizations maintain prospect records, many of which, however, are inadequate because they do not furnish the necessary information with which to control the salesman's activities. As a result, these records are only an additional source of expense rather than profit.

Figure 1 is an example of an adequate prospect record. These forms, a two-card set-up, are used by one large company in the East. On the visible margin of the Kardex pocket is the name and address of the prospect and the 1 to 31 scale which is used for follow-up. To the right, the S.I.D. columns are for signalling whether the prospect is a student, individual or dealer, and space for salesman's number. As a general rule, Kardex prospect records are of two-card variety. The top card, in salmon color, is called the salesman's card which can be removed from the file when the salesman calls on his prospect. Beneath this card is the Master Card which remains in the file.

When the salmon card is removed from the file, it flashes to the attention of the person responsible for the condition of that file, and says: "This card is in the hands of salesman Jones."

This record is maintained by a company who obviously is interested in selling a flying service. Now look at figure 2. Here is a simple one-card prospect record of a company who, for example, might have "Skywriting" to sell.

In all branches of the industry, prospect records will differ but the principle remains the same.

Developing the Present Customer

Every growing business organization must always be on the lookout for new prospects and customers. But, the business which depends upon these new customers alone and is not actively engaged in developing its present customers, is wasting effort. Unless present customers are carefully developed, they cease to remain customers, and the development of prospects into new customers means little if this gain is offset by the loss of a present customer. The popular man is the one who does not neglect his old friends while cultivating new ones, just as the successful business man is the one who does not neglect his present customers while developing new customers.

Some aeronautical concerns have reached the point where two sales managers are employed—one to develop prospects into new customers; the other to develop additional business from present customers. Although this is not the general practice, progressive business organizations appreciate the opportunity offered by existing contacts with present customers and nearly all include this development as a major portion of their sales program. For, after all, present customers offer a tremendously rich sales field and one which should be easier to develop than the lesser known new prospects.

A definite relationship has already been established with the customer. He has become aware of the reputation of the salesman and the firm which the salesman represents. He has, no doubt, already established his credit and started an account. He has experienced the service, the courtesy and the consideration which has been given him in his previous dealings, and, if these have been what they should be, the old customer will be the source of an increasing volume of future business, providing this business is actively solicited.

Customer Service

An old customer is like an old friend; both are entitled to the utmost consideration. If the customer is made to feel that he is a preferred account and that his requirements will be promptly and considerately taken care of, he will remain

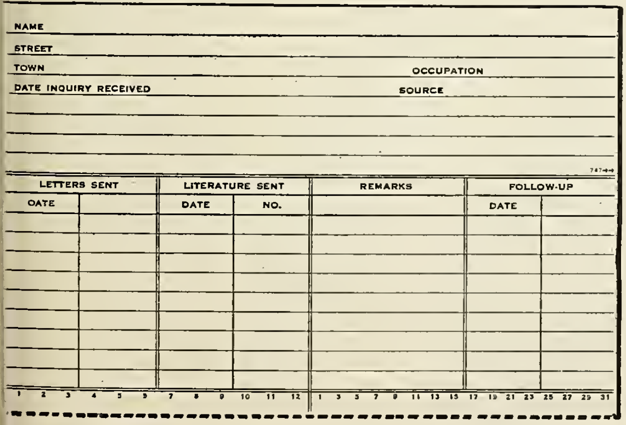
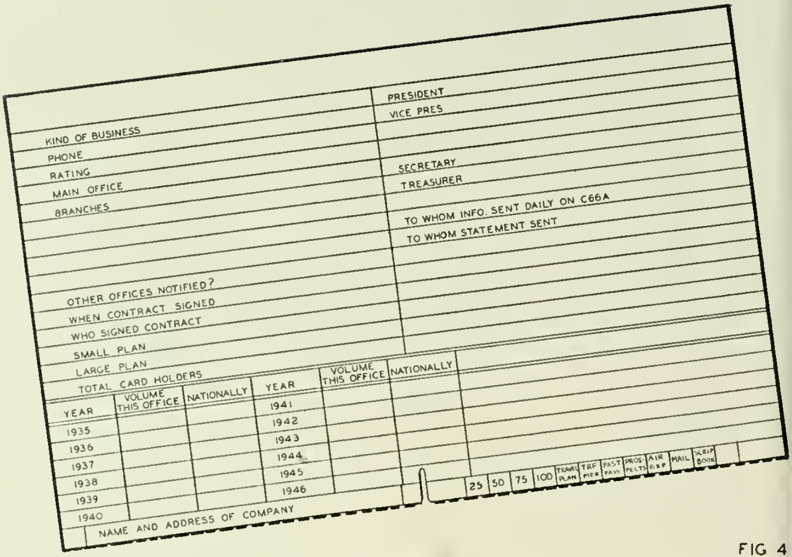


FIG. 2

FIG. 3

a friend and a loyal booster and supporter of that concern. Nine times out of ten he will continue to direct his future orders to the same source of supply, regardless of the promises or attractive prices of competitors. He may also tell his other business associates, thus developing new prospects.

It has often been said that one dissatisfied customer will offset the values gained through ten satisfied customers. This is no doubt due to the natural human tendency to complain about misfortune and to remain silent about good fortune. Many simple difficulties may be quickly and satisfactorily eliminated before they become serious complaints, and it is the sales manager's responsibility to see that this is the general rule. It is also his responsibility to see that each one of the present customers is regularly called upon or otherwise contacted at definite intervals; for the competitor's representative is also trying to procure business from the same customer and neglect nearly always means a new customer for the competitor.



KIND OF BUSINESS
PHONE
RATING
MAIN OFFICE
BRANCHES
OTHER OFFICES NOTIFIED?
WHEN CONTRACT SIGNED
WHO SIGNED CONTRACT
SMALL PLAN
LARGE PLAN
TOTAL CARD HOLDERS
PRESIDENT
VICE PRES
SECRETARY
TREASURER
TO WHOM INFO. SENT DAILY ON C66A
TO WHOM STATEMENT SENT

YEAR	VOLUME THIS OFFICE	NATIONALLY	YEAR	VOLUME THIS OFFICE	NATIONALLY
1935			1941		
1936			1942		
1937			1943		
1938			1944		
1939			1945		
1940			1946		

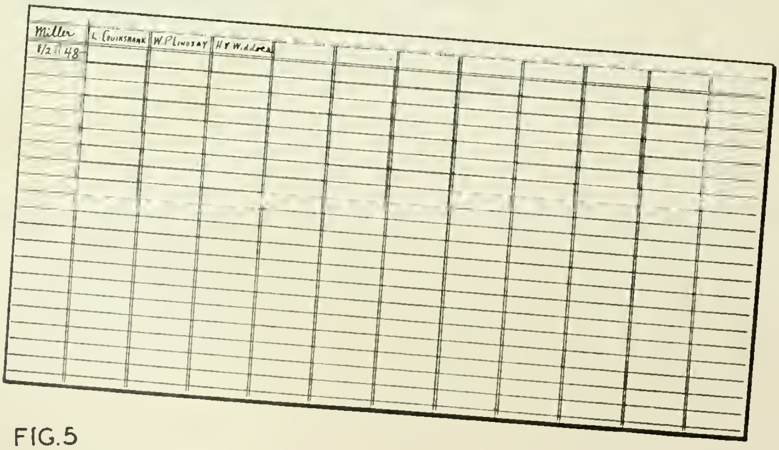
NAME AND ADDRESS OF COMPANY

FIG 4

The Customer Sales Record

In order to perform his duties and to carry out his responsibilities, the sales manager must have definite facts. He must know how frequently his salesmen are calling upon present customers. In order to evaluate the effectiveness of these calls, he must know what percentage of these calls result in orders. The facts are vitally necessary if he is to operate his sales organization on a definite sales program. These facts and figures are easily procured through the use of records. A sales manager who does not have such records is not operating on a definite program and has no means of knowing whether his men are procuring the business which is most profitable and the business which builds friends.

There are many other things which a Customer's Sales Record will show. It will tell the sales manager whether or not the customer is buying all the available products which the customer uses; it will inform him whether or not the field for each product is properly developed; it will advise him at regular intervals of the percentage of the customer's business which his concern has procured and the percentage which is going to competitors. If desired, it will also indicate the percentage of business procured to date this year, in comparison with the business last year. It keeps him informed of progressive or retarding sales conditions. In telling him of these things, the Sales Record is telling the reasons why customers are buying or are not buying. Perhaps the salesman does not call at frequent-enough intervals, or perhaps the price delivery service, the credit arrangements or the merchandise is unsatisfactory. Records will indicate the most likely reason for the lack of sales, making possible its correction and consequent increase in sales.



Miller
8/2 48
L. Cruikshank
W. P. Lindsay
H. V. W. Addrea

FIG.5

The value of this information in the operation of a Sales Department is self-evident. It must be remembered that a sales manager is usually a busy man. He cannot take the time to study the data of a number of individual records to procure his facts. These must be presented to him in condensed, graphic form so that he can quickly analyze an entire territory, a section of his sales organization or a group of lines, at a glance. The sales manager has this feature in visible records. They give him facts graphically, collectively and completely so that a brief analysis of the most vital facts (which are the ones made visible) tells him the story upon which his sales policies must be based.

These facts are pertinent largely to manufacturers of planes and parts of equipment for use in airports and airways. Strangely enough, all of these thoughts are used by transport companies, but in a different manner.

Figure 3 is a simple, but effective form used by one large company today to control the activities of an individual whc uses flying service. The name, addres and phone of the user are on the card a well as such information as trips taken date, from and to and whether this individual is a scrip book holder. If thi passenger is not a scrip user, there is a least one avenue of approach for the sales man contact. These cards are set up i an alphabetic file behind A to Z guide and as a trip is taken, that trip is recorde on the card. The size of the break-dow or division of the set of guides depend upon the number of cards in the file, an while this card is ample for an indivic ual's record, a firm which has man members of their organization using th service, requires a different card.

Figures 4 and 5 show how the activitie of many individuals in one company wh fly are controlled. This form, thoug complicated in appearance, is simple t operate and will be of assistance in buil ing larger business volume. It is

(*Continued on page* 70)

EDITORIALS

"There is little use in sending ships aloft for military missions under adverse weather conditions unless pilots and crew can be comfortable enough to perform their functions. We believe we have now solved the clothing problem except for hand protection, with clothes made out of all-American materials."—CAPTAIN JAMES EARLY, G.H.Q. Air Force.

Keep Science Unhampered

● It was gratifying to see the formation of the Institute of the Aeronautical Sciences, an independent, scientific, engineering body devoted exclusively to the progress of aircraft knowlege. We do not presume to intrude into the workings of a guild of which we are not a member, yet our interest in the successful conduct of such an organization is prompted by the best interests of the industry we represent. An organization with such high aims and broad scope as the Institute must rise above titles, company prestige, importance of university or privileged position of a government institution. Knowledge and achievement of any individual should be his only claim to distinction, and the only claim to be heard should lie in the merit of what he has to say.

It seemed singularly inappropriate at the recent annual meeting to have members of the Institute who are a part of government units (which, at the taxpayers expense, work and dissiminate their acquired knowledge) take advantage of their government connection to impose upon the audience in presenting material which, to a great extent, has been available to everyone for some time. It was neither the time nor place for such papers to be read, since the Institute is dedicated to the advancement of science rather than rehash of available information.

It may be difficult at times to rise above avarice, vanity, and envy, but science must be kept above these if it is to be kept at all.

Fair Procurement Policies

● When contracts by negotiation were done away with and the Act of July, 1926 invoked after lying dormant for some eight years, the industry was led to believe that the competitive system of bids would decide procurements. But not so! After almost two years of operations supposedly according to this law, it became evident that the system is used not to procure aircraft but to wear out the patience and resources of the aircraft industry.

It makes little difference what particular procurement system is used provided it is fair in treatment of *all who are admitted to participate* in connection with any given project. In addition, it should not require excessive time for a decision and should enable our services to acquire ample equipment of superior quality without a lot of mysterious legal loopholes.

And while we are at it, here are a few more questions the Department of Commerce, in connection with its actual and contemplated procurements, might explain:

Why are certain payments on procured equipment not forthcoming to members of the aircraft industry who were led into the expense (and not to mention annoyance) in dealing with the Bureau of Air Commerce?

Why is the six place feeder line transport competition, opened almost four months ago, as yet undecided? Is it because the bids were opened in a basement which is already more than six feet under the ground?

The aircraft industry working on a ten percent basis of profits cannot continue to be made the goat of politicians and career hunters. The backbone of our national defense and transportation progress must have, and deserves, proper consideration.

Safe Flying Is Safe Business

● The Fly Safely Campaign, launched by owners and operators of Stinson planes, is worthy of commendation. These pilots have pledged themselves to assist in increasing public confidence in aviation by flying more safely than ever this year. They have agreed to avoid stunt flying and the taking of unnecessary risks, knowing that this will prove to many skeptics that the airplane is in itself thoroughly reliable when properly maintained and flown with good judgment. The fact that a high-performance airplane is capable of aerobatics should not encourage foolhardy behaviour on the part of the pilot.

The thought behind this crusade warrants its adoption by every private pilot, who, of course, is not restricted in his operations as are the airline pilots. Fewer accidents will do more to eliminate the fear of flying than all the sales talk ever presented. Less fear means more flying and more flying means more business for everyone concerned.

McSwain's Warning

● One of aviation's staunchest boosters in the House of Representatives is the Chairman of the House Military Affairs Committee, the energetic Hon. John J. McSwain. This gentleman from South Carolina has been untiring in his efforts to put the air forces of this country on a basis which would assure its being ready for the emergency that is bound to come, notwithstanding the propaganda of pacifists, communists and others.

Mr. McSwain has repeatedly warned Congress that the United States is lacking in men and planes to meet that national emergency. He favors a $70,000,000 appropriation for 800 new Army planes in the next year which is about one tenth of what should be included in the budget.

Mr. McSwain's foresight is embodied in his bill (H. R. 10662) to promote national defense by organizing an Air Reserve Training Corps for men between the ages of 17 and 24. The bill provides the Secretary of War with authority to detail either Regular or Reserve flying officers to instruct and train cadets in selected private flying schools and centers of air instruction and at such colleges or universities where he deems it advisable to coordinate their courses with primary flight training courses.

Army airdromes and Army equipment could be used under the plan; twenty of the most efficient cadets would be given an opportunity of taking advanced instruction and then be commissioned in the Reserve Corps.

Should the bill become a law, both commercial and military aviation will benefit. Thousands of young people, financially unable at present to learn to fly will be given the opportunity and as their incomes grow, they will become the market for a great number of private aircraft. As they become more airwise, they will form the nucleus of a great and powerful air reserve, ready on short call to meet any emergency that may arise.

If Congress was as farsighted as the Chairman of its House Military Affairs Committee, we would not now be languishing in a position that even a second-rate power would quickly rectify. Our only hope for making and keeping the United States first in Army and Naval aviation lies in the perseverance and courage of men of Mr. McSwain's type.

AIR

HOT AND OTHERWISE

FRANK A. TICHENOR

On Wednesday, February 19th, Brigadier General William Mitchell died. Ten years before he had been sacrificed on the altar of official pigheadedness—court martialed because he dared to speak the truth about air power.

Not every detail of what Billy Mitchell said was true, but the substance was. It is even truer today, too. For Billy Mitchell was the great prophet of war in the air. Not as a visionary, but as a soldier who had seen a quarter century of service, he foresaw that the battle fields of the future would be in the air, not on the ground; that the weapon wielding the balance of power among nations would be the airplane, not the battleship. Because he loved the flag under which he had served so long, he urged his country to prepare *now* for that day he foresaw so clearly. And because he dared to stand up and speak for his convictions, he was denounced and persecuted—even unto his dying days, for even as recently as last month Congress refused to reinstate him on the Army's retired list.

Today it can be said of Billy Mitchell that a prophet is not without honor save in his own country. For today every important nation in the world—except his native land—knows that Billy Mitchell was right. And every important nation except America is acting upon that knowledge. Acting vigorously, concertedly and with a purpose.

Only America continues dilly-dallying—and chattering, chattering, chattering endlessly and aimlessly. There is no evidence in 1936 that the astute statesmen in Congress or the military geniuses in the Services have any clearer conception of what it is all about than they had in 1925. If they did, they would act.

Don't be fooled by their present shouting. They are filling the Congressional Record with eloquent yearnings for a mighty air arm. But do they really mean it? Or if they are sincere, do they really know what they're talking about? Do they actually have any sound conception of the problem?

Don't look in the Congressional Record for the answers to those questions. Look at the Record of Facts.

There you will find a different story—a story of stubborn obstruction, inexcusable blundering, petty politics and obdurate backwardness. And it all adds up to just one thing—the United States of America has the weakest national defense in the world.

Yes, look at the Record. While Congressmen sing praises to the air force as the most vital element in our national defense, they appropriate $543,000,000 for the Army and out of that sum, the greatest in peacetime history, they allot a niggardly $10,669,786 to the purchase of Air Corps flying equipment. The most important branch of the Service, they shout—yet they give it less than two per cent to equip itself to defend the country.

* * *

Those are the facts as produced by Congress. Compare them with the figures of speech as produced by that same Congress. They don't tally. Why?

Is it because the people's representatives are such little men that they are incapable of representing *all* the people, not just a handful of their own constituents? Is it because they are hypocrites? Is it because their minds are too puny to grasp the full scope of the problem?

Probably it is a combination of all these things. But it is especially the latter. There are undoubtedly men in Congress who are sincere. There are undoubtedly men who are patriotic. But there are almost none who seem to comprehend all the factors involved in establishing an adequate national defense in the air. The paltry few—such as Chairman McSwain of the House Military Affairs Committee—who do have more than a glimmering of understanding of the broader implications of how to insure the nation's safety, are almost powerless before the ignorance and voluntary blindness of the majority.

If there were more men with such understanding, Congress would not have accepted with such bovine complacency the startling revelation that the aircraft industry of the United States is incapable of producing as many as 800 military airplanes in one year. That shocking news would not have gone unchallenged. For, if it is true, it is a disgrace to the House of Representatives and to the nation which elected such a House.

Beside that fact, all questions of how large our peacetime Air Corps ought to be, or how much money ought to be appropriated for it, pale into insignificance. Every man, woman or child who knows anything at all about military affairs knows this much—that when war comes, the important thing will not be how large an Army we can throw into action overnight; the standing Army will be woefully inadequate on any count. No, the really decisive factor will be how quickly can an adequate Army be assembled and equipped to go into action. If the factories of this country cannot turn out more than 565 airplanes in one year, God help us! We might as well surrender without firing a shot.

* * *

Yet, the Congress passed over this glaring weakness in our defense structure without even recognizing it as a weakness. It went blissfully on to appropriate a meagre $10,000,000 to build 565 airplanes, satisfied that that was all that could be expected of it because, after all—ho-hum—the factories couldn't build more than that number even if more funds *had* been appropriated. It didn't even occur to these sharp-witted gentlemen that something should be done to correct the condition which limits our annual production to less than 600 planes. They contented themselves with the comfortable delusion that two wrongs make a right.

It is almost inconceivable that one body of men could shoot so wide of the mark. The target at which they pretended to be aiming is adequate air defense. America can score a bull's-eye on that target only by intelligent planning on two fronts—the first is a decently large regular air force to withstand the first blow of war; the other is full provision for sudden expansion in the production of equipment and the rapid training of men to use it effectively. In the Army appropriation bill which has just passed the House, both of these essential factors were miserably neglected.

* * *

During the World War, not a single American-built (let alone American-designed) plane saw combat service over the Western Front. American squadrons flew British and French ships. Next time we may not be so fortunate as to have allies who can make up for our deficiencies. Next time we may not have over a year and a half to get ready to do battle. Next time we may have to depend solely upon ourselves.

Let the Congress think over those facts, too—while it allots $10,000,000 and ignores vital issues. And let it think over the fact that there is no big nation which is not spending twice as much as we on air defense and that most of them are spending three and four times as much Or better still, let Congress think. It would be a refreshing change.

DR. ALEXANDER KLEMIN
GLENN D. ANGLE

AVIATION ENGINEERING

DR. MICHAEL WATTER
DR. MAX M. MUNK

GRAPHICAL SOLUTION OF CONTINUOUS BEAMS UNDER COMBINED LOADING

JOEL M. JACOBSON

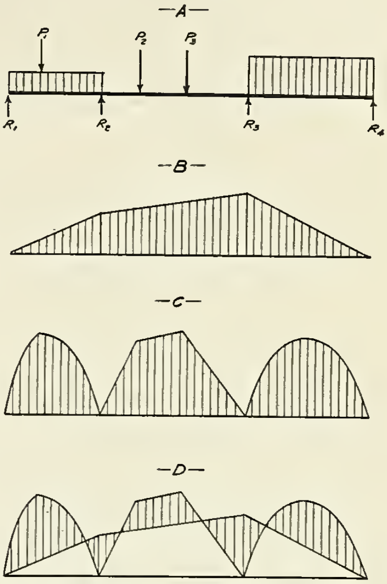


Figure 1. Beam loading condition and bending moment construction

● Practically all graphical solutions for continuous beams subjected to combined bending and compression provide a construction for the bending moment curve only when the end moments in each span have been determined by some other means, usually, the precise three moment equations. By a combination and slight modification of some well-known graphical methods it is possible to solve the entire problem without resorting to any algebraic calculation. Messrs. L. H. Nishkian and D. B. Steinman, in their joint paper published in the American Society of Civil Engineers Transactions for 1927 have presented a graphical solution for the moment diagram for any type of continuous beam subjected to any type of lateral load. This method has been modified to include the effect of the end compression and combined with the construction developed by Dr. Michael Watter (AERO DIGEST, March 1932), to make possible the complete graphical solution of the continuous beam under combined loading.

In the following description of the procedure to be followed no attempt is made to explain the derivations of the basic equations since the original papers referred to above contain complete proofs too long to be repeated here.

The moment curve for any continuous beam may be considered as the sum of two parts; (1) the curve connecting the moments at the supports, a straight line when no end loads are acting, and (2) the simple beam moment diagram. In the sketches of figure 1, for example, *a* represents the beam and loading, *b* the curve connecting the moments at the supports, *c* the simple beam moment diagrams, and *d* the complete moment curve. Since the simple beam moment curve may be readily drawn, the whole moment curve may be constructed if the curve *b* is found.

If any point on the moment line is known, such as the moment at the end support, the conjugate point method of Nishkian and Steinman may be used to locate a corresponding point in the next span. The line connecting the conjugate points in each span will be the curve *b* of figure 1. The mechanical operations involved in this graphical determination are outlined below. The case of uniform moment of inertia in each span is considered first.

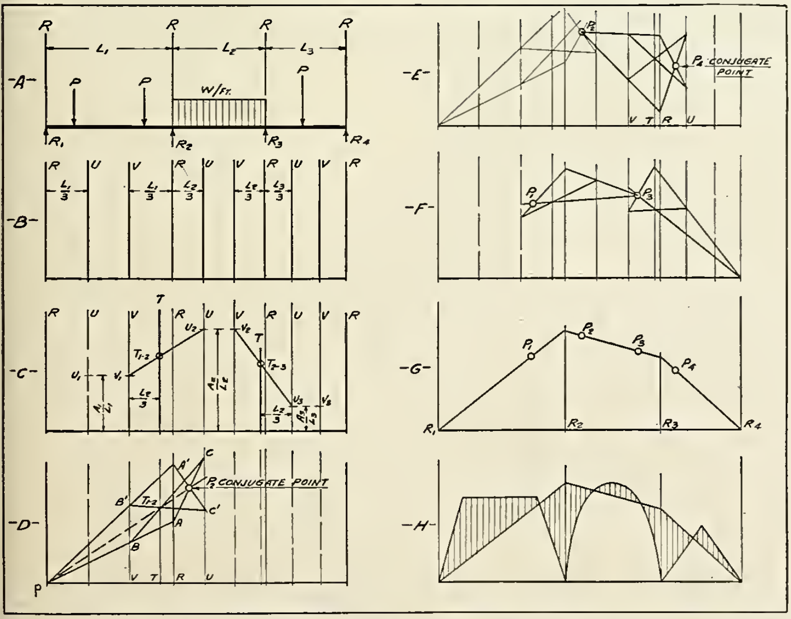


Figure 2. Determination of conjugate points and bending moments for the case of uniform moment of inertia

Conjugate Point Construction

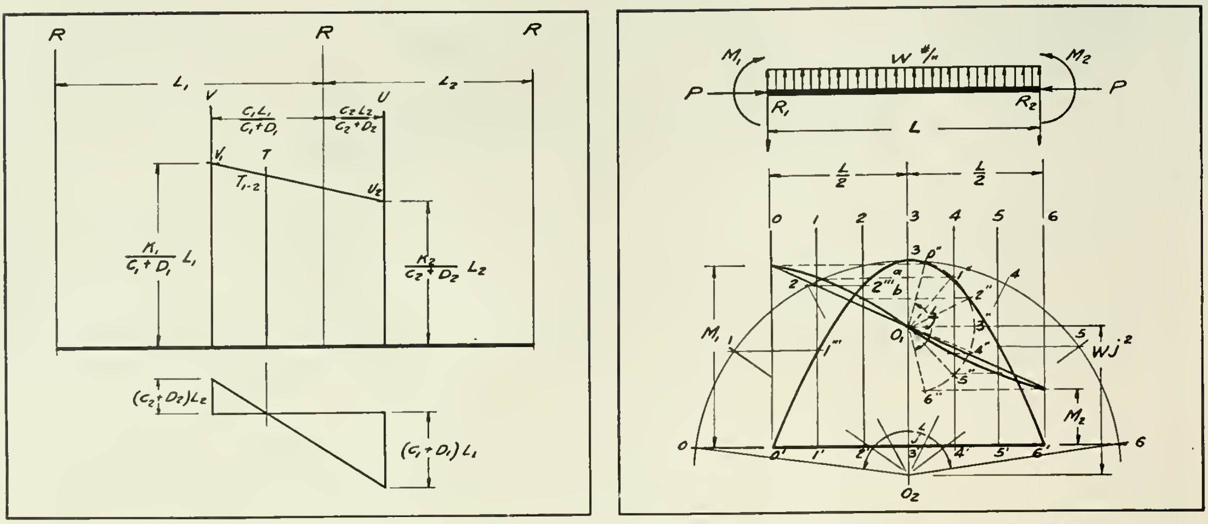
Case I: Uniform Moment of Inertia (figure 2).

Draw the beam centerline to scale, indicating the reaction points by vertical lines through the supports, the *R* lines.

Draw vertical lines through the third points in each span, the *U* and *V* lines.

Transpose adjacent third points, thus locating the transposition, *T* lines, symmetrical to *R* line.

Locate points U_1, U_2, U_3, etc., and V_1, V_2, V_3, etc., on the *U* and *V* lines in each span by scaling upward a distance of A/L where *A* is the area of the simple beam moment diagram for each span and loading, and *L* is the corresponding span.



Figures 3 and 4. Determination of conjugate points for a general case and of the precise bending in a single span

For a concentrated load at midspan, A is $P\,L^2/8$ and for a uniformly distributed load, $wL^2/12$. The value of A for other types of load may be readily determined.

Connect V_1 and U_2, V_2 and U_3, etc., and mark the T points at the intersection with the T lines in each span.

Starting with a known point on the moment line, draw a pennant diagram to locate the conjugate point in the next span. In the illustration (figure 2), the moment at the left support is zero so that the diagram may be started at this point. First draw any line P_1A. Then from the intersection with the V line, at B, draw a line through the T point to intersect the U line at C. Connect A and C, and the conjugate point will lie somewhere on AC. By drawing another random line, P_1A', and repeating the construction of another pennant, the line $A'C'$ may be found. The conjugate point, P, is then at the intersection of AC and $A'C'$. It may be noted that if the random line is started through the T point, the pennant becomes a single line, and the point P may be located by the intersection of this line and AC of the first pennant.

Starting with the conjugate point P_2 found as described above, repeat the entire process for the next span, etc.

Using the right support as the origin, repeat the construction. This will provide two conjugate points in each span.

Draw the closing lines by connecting the conjugate points by straight lines.

Superimpose the simple beam moment diagrams. The intercept between the two curves is then the bending moment in the beam at any point.

Case II: General Solution

In the most general form, the three moment equation may be written:

$$C_1M_1L_1 + D_1M_2L_1 + C_2M_2L_2 + D_2M_3L_2 = K_1 + K_2$$

To solve this case by the conjugate point method, the following changes are necessary in the special solution outlined above. (Refer to figure 3.)

Locate the U lines at a distance uL from the left support where u is $D/C+D$ for the span being considered.

Locate the V lines at a distance vL from the right support where v is $C/C+D$ for the span being considered.

Locate the U points at a distance $K/(C+D)L$ from the base line. The V points are at the same height if the loading is symmetrical. If the loads are unsymmetrical use the proper load term for left and right ends to determine K.

Locate the T lines from the R line in the proportion of $(C+D)L$ for the two spans.

The conjugate points in each span may then be located by pennant diagrams in the usual way. Figure 3 illustrates the construction in the general case. It may be noted that C, D, and K may take any value, the graphical construction being merely a means for solving a set of simultaneous equations of this form. Case I is the general problem's special solution.

Graphical Solution of Precise Equations

The precise three moment equation in its usual form, is:

$$M_1L_1\alpha_1/I_1 + 2M_2L_1\beta_1/I_1 + 2M_2L_2\beta_2/I_2 + M_3L_2\alpha_2/I_2 = w_1L_1^3\gamma_1/4I_1 + w_2L_2^3\gamma_2/4I_2$$

The load terms on the right hand side of the equation depend on the type of loading and the end of the span being considered. For simplicity, only the case of uniform loading is discussed, though any common type of loading could be used.

Comparing this expression with the general form, it will be seen that

$C_1 = \alpha_1/I_1$
$D_1 = 2\beta_1/I_1$
$K_1 = \gamma_1w_1L_1^2/4I_1$
$D_2 = \alpha_2/I_2$
$C_2 = 2\beta_2/I_2$
$K_2 = \gamma_2w_2L_2^2/4I_2$

From figure 3 it may be seen that only three quantities need be found for each span to locate all the points required to start the conjugate point construction. These are, (1):—$CL/C+D$ (identical with $DL/C+D$ when the load is symmetrical); (2):—$(C+D)L$, to locate the transposition lines; and (3):—$KL/C+D$ to determine the height of the U and V points. Replacing C, D, and K, with the values found above:

The distance of the U line from the adjacent R line is $DL/C+D = \alpha L/(\alpha + 2\beta) = uL$ where u is $\alpha/(\alpha + 2\beta)$.

The distance of the V line from the adjacent R line is $CL/C+D = \alpha L/(\alpha + 2\beta) = vL$ where v is $\alpha/(\alpha + 2\beta)$.

The height of the U and V points is, for uniform loading, $KL/C+D = \gamma wL^2/4I(\alpha + 2\beta) = \triangle wL^2/4I$ where $\triangle$ is $\gamma/(\alpha + 2\beta)$.

The parameter used to locate the T line is

$$(C+D)L = (\alpha + 2\beta)L/I = \varepsilon L/I$$

where ε is $(\alpha + 2\beta)$.

The values of u, v, $\triangle$, and ε, have been tabulated below for various values of L/j by reducing the tables for α, β, and γ given by Niles and Newell (*Airplane Structures*). While the parameters u, v, and ε, apply unchanged to any form of loading, the term, $\triangle$, is to be used only for uniform loading. The height of the U and V points for any type of loading may be found by reference to the basic equations. The load term K may be found from any reference on structural analysis for a large number of special cases and the value of $KL/C+D$ determined.

After the U, V, and T points have been found, the procedure is identical with the general conjugate solution described above. Starting with a known point in any span, pennant diagrams are drawn to find the corresponding point in the next span. The intersection of the closing lines at supports determine the moments.

Construction of Precise Moment Curve for Each Span

Once the bending moments at the supports have been determined, the moment diagram within each span may be drawn by a modification of the method developed by Watter and extended by Renato Contini, in AERO DIGEST for October, 1935. The construction described here has been arranged so that it may be superimposed directly on the conjugate point solution for the end moments. The steps in the procedure are, referring to figure 4:

From the conjugate point construction, locate the end moments at the supports, M_1 and M_2, on the R lines.

Connect the two points thus located with a straight line. Find the intersection of this line with a vertical through the center of the span, point O.

Measure vertically from O, a distance equal to wj^2, downward when positive.

At O_2 lay out an angle of $L/2j$ on each side of the vertical O_2O_1. The sides of this angle will then intersect the beam base at o and 6.

With O_2 as center and O_2o as radius, describe the arc o-6.

Divide this arc into a number of equal parts, in this case, six. Divide the span into the same number of equal parts and draw verticals through each.

Project each point of the arc to an intersection with the corresponding vertical and connect these intersections with a smooth curve.

At O_1 lay out an angle on each side of the horizontal equal to $L/2j$.

Project the known end moments to intersect the sides of the angle at o'' and $6''$.

Constants for Graphical Solution of the Precise Three Moment Equations

L/j	ε	u = v	Δ
0.00	3.0000	.3333	.3333
0.50	3.0642	.3362	.3347
1.00	3.2778	.3449	.3390
1.10	3.3441	.3474	.3402
1.20	3.4207	.3502	.3416
1.30	3.5086	.3533	.3431
1.40	3.6098	.3567	.3447
1.50	3.7264	.3605	.3465
1.60	3.8610	.3646	.3484
1.70	4.0176	.3691	.3505
1.80	4.2004	.3740	.3528
1.90	4.4158	.3793	.3553
2.00	4.6723	.3851	.3579
2.10	4.9809	.3913	.3607
2.20	5.3584	.3982	.3637
2.30	5.8290	.4055	.3670
2.40	6.4304	.4136	.3704
2.50	7.2230	.4223	.3742
2.60	8.3122	.4317	.3781
2.70	9.9004	.4420	.3824
2.80	12.4241	.4533	.3870
2.90	17.0433	.4655	.3919
3.00	28.2029	.4788	.3971

Divide the arc o''-$6''$ into the same number of equal segments used above.

Project each point on the arc to an intersection with the corresponding vertical and connect the points with a smooth curve.

The moment at any point in the beam will be the intercept between the two curves thus drawn.

Solution of a Typical Problem

To illustrate the complete procedure a simple example, a five span continuous beam with a uniform load, is solved by the graphical method (in figure 5). The data used in the problem is:

Span	1-2	2-3	3-4
w	20#/″	20#/″	15#/″
I	100	100	80
E	....	1,300,000#/sq. in.	....
P	9200#	28,800#	44,000#
L	180″	180″	120″

From the above data, the following constants may be computed:

j	118.8	67.2	48.6
L/j	1.515	2.68	2.47
wj^2	282,700	90,300	35,400

From the table of constants for the conjugate point construction:

ε	3.75	9.53	6.94
u	.36	.44	.42
Δ	.347	.382	.373

and

$\Delta wL^2/4$	56,200	61,800	20,150

The moment at the end support will be the cantilever moment of the overhang, 47,040″#. This value is plotted upward on the R line at the end support and becomes the first conjugate point from which the first pennant diagram is started. Since the beam in the example is symmetrical about the centerline the construction need be carried out for only three spans.

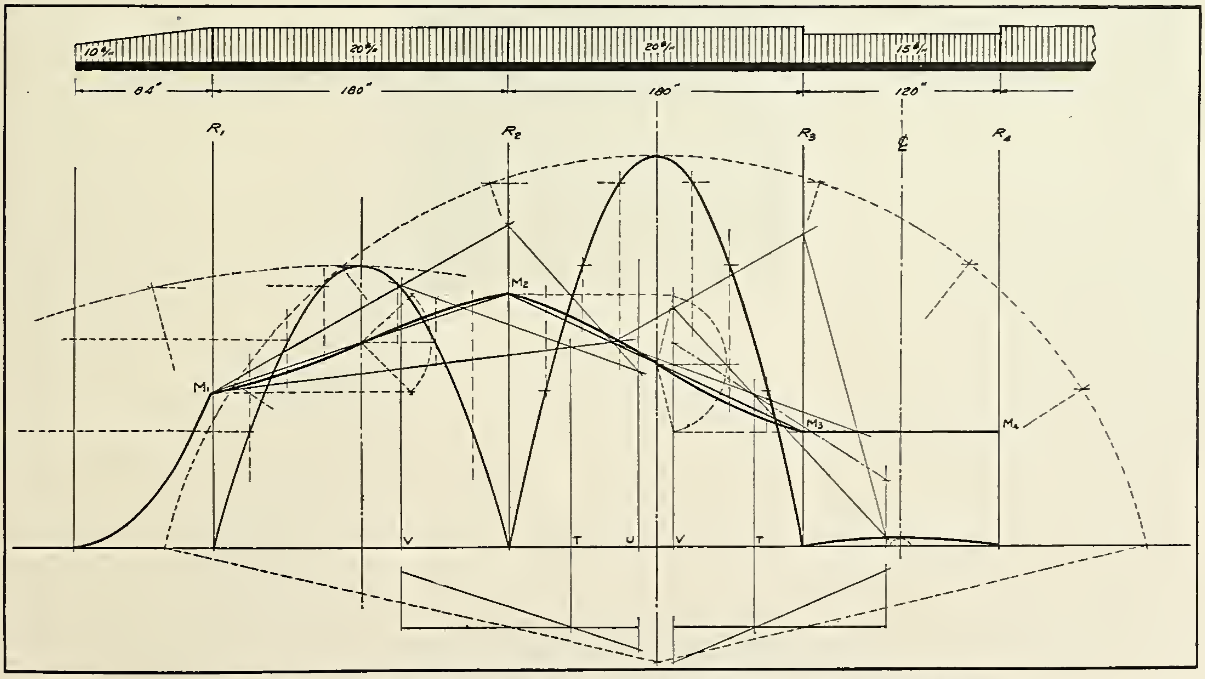


Figure 5. Complete graphical construction of precise bending moment for a continuous beam

Compression Tests of Stainless Steel Sections

●

EDWIN W. WALKER
Brewster Aeronautical Corporation

● The purpose of this article is to present a practical and easy-to-use set of curves for the determination of the stresses of various bent or drawn stainless steel sections under compression loads.

At present, stainless steel is becoming more widely used in all-metal aircraft construction. Engineers are becoming more familiar with the design of fittings which may be readily fabricated by shot-welding and shop men are becoming more adept in fabricating the ¾-hard and full-hard stainless steel sheet.

There is a definite need at the present time for design data which will give the compression strength of various sections used as truss members and as stringers or skin stiffeners in stressed skin construction. Such data must give the allowable stress of any member with as little work as possible.

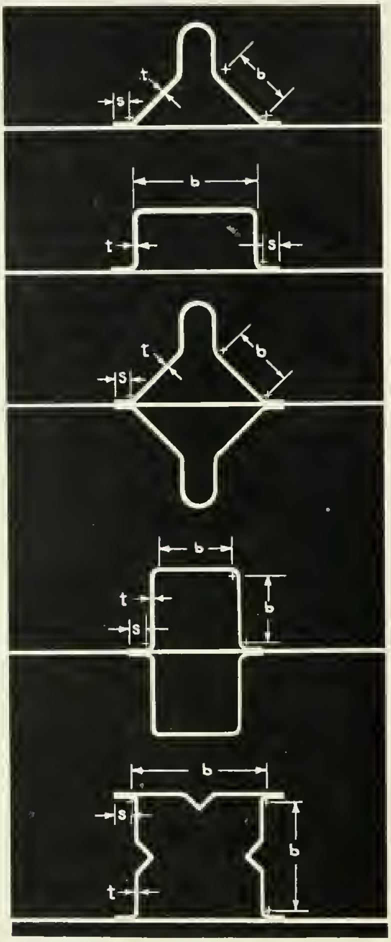
These allowable stress curves are based on tests made over a period of years, most of the tests being conducted at various stages of the design and construction of stainless steel floats and hulls. The column tests were made using a steel ball at each end, or in the case of a number of stiffeners a round steel rod, bearing on a flat steel plate, to simulate a fixity of $c=1$. In one test, a stainless steel section was tested with flat ends bearing on rigid steel plates for comparative purposes only and it was found that the fixity was approximately $c=3$. Since the fixity of the compression member may vary from $c=1$ to $c=3$ (depending on the type of construction used) the stress may readily be found for whatever fixity is wanted as follows:

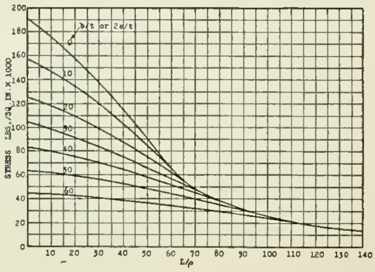
$$\text{For any fixity } L/\rho = \frac{L/\rho \text{ (for } c=1)}{\sqrt{c}}$$

For example, if a fixity of $c=2$ is desired, divide the computed L/ρ by $\sqrt{2}$ and use this value of L/ρ for determining the stress from the curves.

Three types of failure occurred in these tests. Given in the order of their importance with respect to drawn or bent up sections having free edges or partially restrained free edges, they were: local buckling of a free edge occurring in the short column range (L/ρ less than 80 approximately); bending of the column into a continuous curve from end to end (Euler or Long column of L/ρ greater than 80); and torsion failure—twisting of the column due to lack of torsional rigidity.

The first and most important type of failure is due to local buckling or crinkling of a free edge or buckling of the back. The back of a section may be described as any width between free edges or any width between corners or sharp breaks in the section. This type of failure can be forecast in a column of new and untested section with a fair degree of accuracy.





Stainless steel column curves
(Fixity c = 1)
Material used: 18% chromium and 8% nickel. Ultimate tensile strength 185,000 to 190,000 lbs./sq. in. Yield point (.002 in./in.) 160,000 to 165,000 lbs./sq. in.

The second type of failure mentioned is called a bending or long column failure which is in the form of a gradual bending from end to end of the column. The stress at which such a failure occurs in all columns having a greater L/ρ than 80 approximately may be calculated using the Euler column formula for stress:

$$S = \frac{C\pi^2 E}{(L/\rho)^2}$$

where $E=26{,}000{,}000$

The third type of failure mentioned is called a torsional failure and is considered unimportant in as much as this type could not occur in skin stringer combinations. They did occur in the long column range in the test of sections which were obviously inefficient as individual compression members.

To facilitate the use of the curves of allowable stress it is necessary to give a discussion of the results. It was found that when the length of free edge s was less than ½ the length of a back b between corners, the failure occurred in the back b. When the free edge was greater than ½ the length of the back the failure occurred in the free edge.

In the case of closed sections, such as illustrated, the proportions are generally such that the free edges are small relative to the sides or back (the free edges of shot welded stainless steel sections are unlike the free edges of aluminum alloy built up sections with its minimum edge distance from rivet holes and resulting larger free edge). Failure in the case of sections having free edges was along the side b. Therefore, the designer in applying the curves to a section similar to these, will use the curve of the series given which is nearest the b/t of the section he is using. The value of L/ρ to be used for the abscissa of the curve may then be computed and corrected to whatever fixity is wanted by the method explained above. The ordinate of a point thus determined will be the ultimate allowable compression stress.

These curves were checked against some of the skin stringer tests of Air Corps Information Circular 697 entitled *An Investigation of the Compressive Strength Properties of Stainless Steel Sheet-Stringer Combinations* and it was concluded that if care is used in the selection of b/t and s/t, the curves may be used for any skin stringer combination.

Institute of the Aeronautical Sciences' Fourth Annual Meeting

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DR. MICHAEL WATTER

● The Fourth Annual Meeting of the Institute of the Aeronautical Sciences was held on January 29-30 and 31, 1936, at the Pupin Physics Laboratories of Columbia University. The meeting covered presentation and discussion of papers, business session and the annual dinner during which two talks and motion pictures of technical interest were presented. During the three days of the program, the mornings were devoted to the presentation of short papers while in the afternoons surveys of specialized fields were given intended to estimate our state of knowledge and to indicate the studies and research most profitable for future progress. Although a great variety of subjects was presented and the arrangement enabled one to participate in all the sessions this schedule may be justified only because of practical limitations. The morning sessions proved to be too short for a lucid and extensive presentation by individual speakers. Extemporaneous discussions are seldom fruitful. In this respect the precedent of older scientific societies should be followed and it is believed to be under consideration by the Institute. The afternoon sessions were more interesting and most of the speakers showed a masterly handling of their subjects.

Engines and Propellers

The first day's morning session was devoted to Engines and Propellers with exception of one paper which properly belonged to the experimental aerodynamics.

The first paper presented was by G. P. Bentley and C. S. Draper of Massachusetts Institute of Technology on *Measurement of Aircraft Vibration During Flight.* It treated the description, principle of operation, calibration and sample records of a special instrument developed for the purpose of recording both torsional and linear vibration. The important place of vibration in structural problems explains the need of these records. The instrument consists of a "seismic" pickup unit, integrating circuit and a photographic oscillograph of the electromagnetic type. Bureau of Aeronautics of U. S. Navy cooperated with M. I. T. in this development.

David Bierman of the National Advisory Committee, spoke on *Compromises in Propeller Design.* The contradictory requirements of propeller operations at high and cruising speeds with those during take-off, in the opinion of the speaker, could be best met by a compromise design.

The propulsive efficiency at low speeds can be considerably improved by a small sacrifice in propulsive efficiency at high speed by the expedient of selecting larger diameters and smaller blade settings. In connection with this, the speaker recommended overspeeding the engine on take-off rather than boosting it to increase the brake horsepower. The paper did not mention the tip speed effect which at present seems to be the limiting factor in choice of propeller diameters.

In the paper *Harmonic Analysis of Engine Torque Due to Gas Pressure* by E. S. Taylor and E. W. Morris of M. I. T., the authors analyze a series of indicator diagrams, which were obtained on the NACA universal engine. The M. I. T. pressure indicator was used to trace the diagrams of the desired conditions. From a plot of torque against crank angles, coefficients of the harmonic series were determined by means of a Coradi analyzer. The authors conclude from their studies of the plots obtained, that the torsional "roughness" of an engine with more than six cylinders is approximately inversely proportional to the square of the number of cylinders.

C. F. Taylor of M. I. T. in his paper *Some Factors in the Design of Ports and Valves* indicated possible desirable changes in port shapes and valve sizes. In the case of exhaust valves the decrease in size seems to be fully justified, but since no effect of the exhaust system was considered, the final conclusions must wait more comprehensive experiments.

C. S. Draper of M. I. T. presented a paper on *Description of New Instrument Laboratory at Massachusetts Institute of Technology.* The paper covered the description of a recording mechanical unit, mechanical vibration apparatus, compass analyzer, humidity apparatus, thermometer lag apparatus, and gyroscope rotor drive apparatus. The paper by Th. Troller of the Daniel Guggenheim Airship Institute in Akron, was entitled *The Whirling Arm in Aerodynamic Research.* The author outlined numerous experimental problems which are preferably treated by means of the whirling arm experiments such as curvilinear dirigible flight, lateral stability of airplanes while turning, etc. Greater economy of this method as compared to wind tunnel testing was stressed.

The afternoon of the first day's session was devoted to *A Survey of Engine Development* the presentation being made by Arthur Nutt, of the Wright Aeronuatical Corp., who acted as chairman at this session. The outstanding developments and trends in aircraft engines during the past year, in his opinion, are: introduction of the dynamic damper; trend toward double-row radial air-cooled engines; continued development of liquid-cooled engines; development of automatic control devices; increased development of higher octane number fuels; decrease in fuel consumption of aircraft engines; and continued predominance of single-row radial air-cooled engines in the field below 1000 h.p.

The ensuing discussion was mainly on liquid versus air-cooled engines with a passing mention of Diesel aircraft engines. The Propeller Advances session which closed the day was presided over by Frank W. Caldwell who gave a comprehensive survey of the field.

Aerodynamics

The morning of the second day was devoted to Aerodynamics with a total of nine scheduled speakers. E. A. Stalker of University of Michigan who was to speak on boundary layer control and turbulence could not attend, and Otto C. Koppen of M. I. T. presented his paper on *Some Recent Developments in Longitudinal Stability* in the afternoon.

R. K. Mueller of M. I. T. presented a paper on *Illustration of an Electrical Device for the Solving of Longitudinal Stability of an Airplane.* The purpose of this instrument is to obviate the necessity of solving three simultaneous differential equations necessary in the determination of dynamic longitudinal stability. The machine consists of a system of electrical elements and circuits capable of adjustment so that the equations indicating the behavior of various electrical currents with time look exactly like the stability equations. The desired answer is measured directly by suitable instruments. The artifice of electrical analogy is finding broad application in the solution of aerodynamic problems and this is an interesting instant of its use.

Alexander Klemin and B. F. Ruffner of the Daniel Guggenheim School of Aeronautics, N. Y. U., spoke on *Operator Solutions in Airplane Dynamics.* Their paper presented a mathematical aid in the solution of the analytical problem of dynamical stability of airplanes. The artifice of the use of the operator makes it possible to solve the equations of dynamic stability with due allowance for initial disturbance and with simplification of the mathematical manipulations involved. Although necessarily requiring some simplifying assumptions, the method is of considerable interest because of greater speed and accuracy afforded by it.

Otto C. Koppen stressed the fact that statical longitudinal stability is not necessarily an indice of dynamic stability. Illustrating this fact with several sample calculations intended to throw light on factors to be taken into account, the speaker gave criteria to be used in design to obtain the desired degree of stability.

H. Peters and J. Bicknell of M. I. T. presented *Study of Mixing Between a Jet of Fluid of Various Densities and a Still Fluid,* while G. G. Rossby of the same institute spoke on *Dynamical Stability of Curved Flow.* The first paper presented the observations and conclusions arrived at from a series of laboratory experiments while the second was based on the observation of Gulf stream and bears relationship both to meteorology, and oceanography.

M. Rauscher of M. I. T. presented *Model Experiments on Flutter at Massachusetts Institute of Technology.* The paper treats the problem of flexural-torsional flutter and covers a part of the intended investigation of the complete theory of flexural-torsional-aileron flutter. These tests were conducted with an airfoil in which the mass, center of gravity location, moment of inertia, and rigidities were variable within wide limits. The tests were made in the presence of a fuselage. One of the observations made in connection with these tests was that, "As a rule, the flutter was symmetrical at low angles when c.g. was forward and the flexural motion predominated; when the flexural motion became subordinated (as at a high angle of attack, or because the c.g. was far in the rear) antisymmetrical flutter would frequently appear at critical speeds apparently in line with those corresponding to symmetrical flutter."

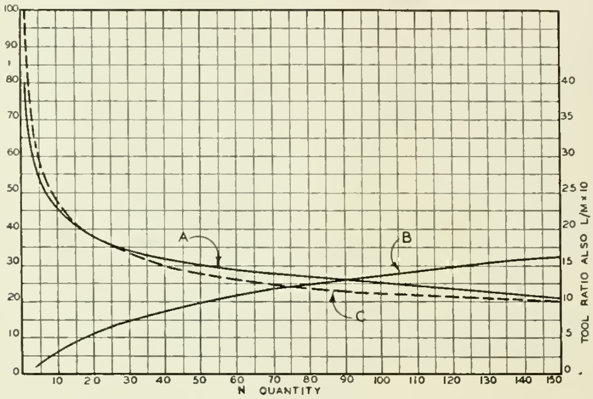
Clark B. Millikan of California Institute of Technology read the paper *Stalling of Tapered Wings.* The speaker presented experimental data on two tapered wings with taper ratio of 5:1 and two aspect ratios 8.9 and 11.06, the first using NACA 23017 at the root, and NACA 23006 at the tip; the second NACA 23020 at the root and NACA 23012 at the tip. Flow pattern was photographed by the use of "tuffs." The premature stalling of the tips was observed and the tests were investigated in the light of the conventional wing theory using data in the Appendix of Fuchs-Hops-Seewald book *Aerodynamik* Vol. II. Since the theory partly confirms the experiments for untwisted tapered airfoils, a future research program is suggested to clear up the entire question of the stalling of tapered wings. The research as proposed did not include, however, the variation of R.N. for a given series of tests and it must be expected that this will be found to have a mitigating effect on the degree of tip stalling.

Although the speaker mentioned the fact that the tests at Cal. Tech. were made at Reynolds Numbers of 1.2×10^6 and 1.5×10^6 based on mean chord he did not state the expected R.N. for full flight conditon. In connection with this it must be mentioned that J. F. Parsons of the NACA discussing *Span-Load Distribution on a Tapered Wing as Affected by Partial Span Flaps from Tests in the Full Scale Tunnel* did not convey by the lift distribution curves presented, the extreme picture painted by Millikan.

The afternoon sessions were devoted to Stability and Control Research with Hugh L. Dryden as chairman, A Survey of Aerodynamics with Clark B. Millikan as acting chairman and Structural Problems with Prof. Newell as acting chairman. In his introductory remarks, Dryden stressed the importance of the development of the spinning tunnel and stated that future development in the study of control and stability is likely to be along that line since "the model solves its own differential equations and determines its own parameters." This new line of attack will not supersede the present type of measuring test equipment for fundamental research.

In control research the realization of the importance of dynamical aspect was stressed. The discussion of the topic of control and stability veered to the problem of two versus three—control operation without revealing, however, anything new.

In his survey of aerodynamics Millikan made a thorough presentation of the problems stressing their state and relative importance. He subdivided the field into three major groups—wings, air-



Curves of costs vs. number of airplanes. A—Ratio of labor to raw material. B—Ratio of tools to construction. C—Labor percentage

Specifications of Assumed All-Metal Airplane

Capacity	4 to 5 place	Useful load	1,400 pounds
Engine	300-400 h.p.	Light weight. . . .	2,200 pounds
High speed . . .	175-200 m.p.h.	Gross weight. . . .	3,600 pounds
Speed range.	3	Structural weight .	1,600 pounds

Unit Airplane Prices

Quantity.	25	100	500	1,000	10,000	100,000	250,000	1,000,000
Factor (%).	.43	.29	.20	.168	.10	.07	.061	.05
Price ($)	18,000	12,140	8,360	7,040	4,180	2,930	2,550	2,090
Unit price ($/lb.).	8.18	5.52	3.80	3.20	1.90	1.33	1.16	.95

Approximate Automobile data

Quantity.	1,000	10,000	100,000	250,000	1,000,000
Weight (lbs.)	6,000	3,700	3,400	3,250	2,900
Price ($).	4,700	1,200	1,000	750	650
Unit price ($/lb.).	.783	.324	.294	.231	.224
Ratio of unit prices - plane to auto. .	4.1	5.86	4.53	5.02	4.28

Notes

Average ratio unit price plane to auto is about 4.75
Small fluctuation from average unit price ratio indicatee similar auto production curve.
Airplane has greater weight economy (50% lighter than auto).
Horsepower per person: Auto 25, Airplane 75.
Plane cruising speed vs. auto: 175/57 = 3:1.
Plane block-to-block time for 300 air miles vs.auto: 10 hrs./2 hrs. = 5:1.

Airplane and auto price variation, from T. P. Wright's paper plane and fluid mechanics, and pointed out that the following problems were in need of greater practical understanding; wing thickness function, suction boundary layer control, non-stationary flow (super lift, hysteresis, time lag, and gusts), model drag and maximum lift extrapolations and problems of turbulence.

In the discussion, Dryden outlined the experimental techniques for studying turbulent air flow and Theodorsen spoke on theoretical work in connection with two dimensional airfoil air flow. Theodorsen stated that practical applications of this theoretical problem are made possible through information contained in NACA T.R.383, 411 and 496.

Prof. Newell, as chairman of the session on structural problems, gave a comprehensive review of the present state of our knowledge. R. D. MacCart, U. S. Navy, in discussing the subject pointed out the experimental nature and limitations of our structural methods.

Aircraft Operations

In the morning session of the third day nine papers were presented dealing with aircraft operations.

T. P. Wright of the Curtiss-Wright Corp., presented an interesting paper entitled *Factors Affecting the Cost of Airplanes,* which gave the results of a study initiated in 1922. The speaker undertook a detailed discussion of numerous factors entering into the problem such as design factors, changes, effect of size, effect of quality, material, overhead, complete airplane, non-consecutive orders, unit cost, etc. The information is of considerable practical interest and is put in a concise and usable form by various

(*Continued on page* 70)

The Roadable Autogiro

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● The "roadable Autogiro" now being constructed for the Bureau of Air Commerce of the Department of Commerce, under contract by the Autogiro Company of America at Willow Grove, Pa., incorporates a road drive mechanism permitting its use on roads when the propeller is disconnected. The rotor blades can be quickly folded and the machine driven on the road by means of power transmitted to the tail wheel. It can be housed in a space measuring about 7 × 24 ft.

Elimination of wings and the availability of "direct control" through the rotor, give adequate control in the air with no forward speed. Performance characteristics and some design details are not accurately predictable as yet, and its probable price and time of commercial introduction have not been determined.

The design provides for the installation of the engine aft of the enclosed cabin. The engine drives a forward extension shaft between the two passengers, the portion through the cockpit being encased in a metal housing tube. This shaft drives twin propellers rotating in opposite directions. The rear drive of the engine actuates another transmission shaft geared to the tail wheel for use on the road. The front gear box contains gears and shafting to actuate the propellers, starting drive and the necessary clutches.

The direct take-off feature consists of a rotor-power drive with hydraulical locking mechanism which enables the retention of small incidence of the blades while revving up the rotor before the take-off. The jump-off is accomplished by releasing the blades to allow them to assume a normal flying attitude, thus instantly creating lift which results in a take-off without any forward run.

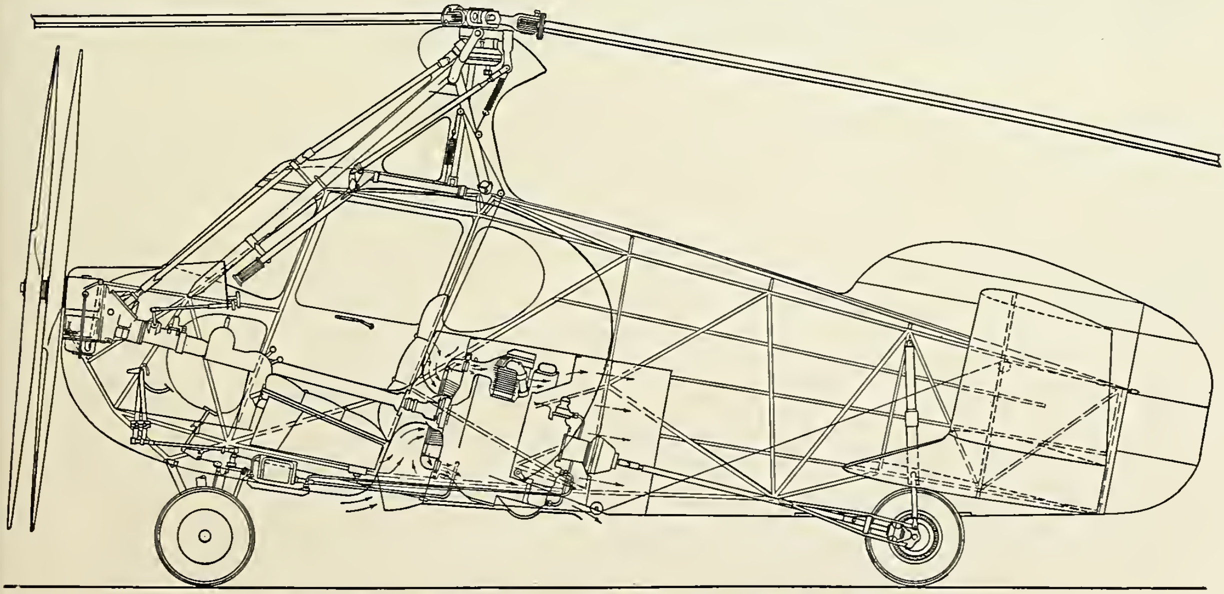
The control lever, suspended from the upper front part of the cabin through an appropriate push pull and lever system, enables tilting of the rotor hub unit.

Finned tip extensions of the horizontal stabilizer, besides providing vertical area, are used to support two rotor blades (the third resting on the fin proper) while at rest or on the road.

Front wheels are brake-equipped with knee action shock absorber suspension. They are provided with steering knuckles and are castered to permit drift landings.

The seven cylinder air-cooled, radial geared Pobjoy engine, having a bore of 77 mm., a stroke of 87 mm., delivers 90 h.p. at 3500 r.p.m., and is used both for propelling in the air and on the road. Special systems of inlet and outlet ducts provide ample engine cooling under all operating conditions. The following approximate specifications and performance figures are based on the experimental machine (without the road drive mechanism) which has flown about 150 hours.

Gross weight	1350 pounds
Overall length	24 feet
Overall height	8 feet
Overall width (blades folded)	7 feet
Wheel tread	70 inches
Wheel base	114 inches
Tire size	7.00 × 5.00
Maximum speed on the road	25 m.p.h.
Maximum speed in flight	115 m.p.h.



Internal arrangement of the roadable, direct control and jump take-off autogiro

THE JACOBS 285 H.P. L-5 & L-5M ENGINES

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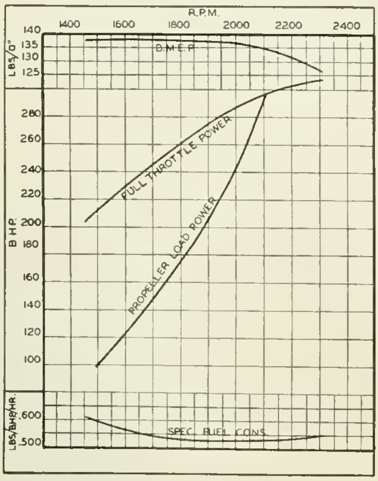
● The Jacobs Model L-5 dual battery ignition and Model L-5M dual magneto ignition engines have been added to the aircraft engine line of Jacobs Aircraft Engine Co. to power aircraft with higher horsepower needs than those supplied by the 225 h.p. Model L-4. The new engine is a seven cylinder, radial, air-cooled type, rated by the Department of Commerce, under A.T.C. 156, at 285 h.p. at 2000 r.p.m. at sea level. At cruising speed of 1900 r.p.m. the engine develops 210 h.p., and maximum horsepower available for take-off is 300 at 2125 r.p.m. at 28" Hg.

The engine has a 5.5 in. bore, 5 in. stroke and cubic inch displacement of 831. The overall length from end of propeller shaft to end of electric starter is $36\frac{31}{32}$"; overall diameter is 43½". The dry weight of the Model L-5 battery ignition engine, including a 15-ampere generator and voltage regulator box, two battery timers, two ignition coils, set of plain ignition wiring and spark plugs, carburetor and front and rear propeller hub centering cones and nut is approximately 460 lbs., providing a weight/horsepower ouptut ratio of 1.61. Fuel consumption at full throttle is .53 lbs. per b.h.p./hr. Fuel consumption at cruising speed is 15-17 g.p.h. Oil consumption at cruising speed is one quart to three pints per hour. Dry weight of the Model L-5M magneto ignition engine is approximately 470 lbs. Fuel and oil consumption are the same as for the Model L-5.



Power, and propeller load curves

Because of the wide spread and increasing use of radio and other electrical equipment in modern aircraft, Jacobs has continued its practice of making battery ignition standard equipment on the new engine. The new engine is provided with a 15-ampere generator as standard equipment. The magneto ignition engine is identical with the battery ignition engine with the exception of the rear accessory drives, rear accessory case and ignition units. Both models provide for mounting direct cranking electric starters and generators. The battery ignition engine can be provided with an auxiliary drive unit providing four drive outlets for mounting fuel pump, vacuum pump, constant speed propeller governor pump and a gun synchronizer unit. Three of the drives are at crankshaft speed and one is at one-half crankshaft speed.

Construction of the crankshaft is of the two-piece type, of heat-treated chrome nickel molybdenum steel forgings, machined and ground all over. The front end incorporates an S.A.E. #20 spline. The crankshaft is mounted on four Marlin-Rockwell ball bearings—one thrust bearing, two main crank pin bearings and a supporting bearing at the extreme rear end of the crankshaft in back of the accessory driving gears.

The master rod is machined from a heat-treated chrome nickel molybdenum steel forging, ground and polished all over. Knuckle pin holes are ground to a tolerance of .0002. Piston pin bushing and master rod bearing are diamond bored in place. The master rod bearing is a heavy steel back, with a thin lining of cadmium silver alloy. The bearing is shrunk into the master rod and rigidly located to prevent any rotating or end movement.

Link rods are forged heat-treated aluminum alloy and are highly polished all over. Piston pin and knuckle pin holes are diamond bored.

Cylinders are machined from forged chrome molybdenum steel and the bore is ground and honed. The cylinder heads are cast from heat treated aluminum alloy castings, screwed and shrunk on the barrel. The head is of an improved design providing ample fins for cooling the exhaust valve seat, port and rocker box. The rocker arms are fitted with Timken rocker arm bearings and lubrication is through an alemite hydraulic fitting. Application of proper rocker arm bearing grease every ten hours provides ample lubrication.

Exhaust valves are of the tulip type, sodium cooled, and are manufactured from CNS steel; intake valves are of the tulip type, solid stem, manufactured from CNS steel, and both are of Thompson manufacture.

Pistons are of forged heat-treated aluminum alloy and are machined to a weight tolerance of .02 lb. They are fitted

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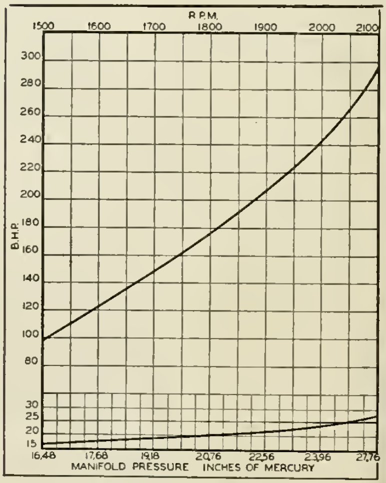


Jacobs L-5 engine power curves

You can follow the same course with the same *Satisfaction*

WHEN 3 OUT OF 4 OF THE MAJOR AIRLINES use the same brand of petroleum products, *you* can safely count on that brand.

TWA, Braniff, Delta, Hanford and Northwest . . . all have selected Texaco Aviation Products. They find Texaco Lubricants *maintain pressures* and lubricate effectively at high temperatures.

You are assured positive lubrication on cold take-offs . . . and when your ship is flying in high altitudes.

You can depend on your engine

Engines that falter, that worry the pilot, often are suffering from oils *imperfectly refined.* They have not been completely freed from the harmful impurities that cause trouble in the engine.

But you can forget all that when you order *Texaco.* You run no risk from hard flinty carbon . . . or sludge . . . or gummed-up piston rings.

Texaco Aviation Products are especially refined for our own Aviation Division. Look for the Texaco trade-mark at all important airports.

THE TEXAS COMPANY
135 East 42nd Street • New York City
Nation-wide distribution facilities
assure prompt delivery

TEXACO *Aviation Products*

(*Continued from preceding page*)

with four U. S. Hammered piston rings of a special type.

Crankcase is of the split type. The rear half is a heat-treated magnesium alloy casting and incorporates a ring type manifold and oil sump surrounding the inlet passage to the manifold providing a means for heating the mixture and preventing the formation of ice at this point. The front half of the crankcase is a casting of heat-treated aluminum alloy and incorporates a support for the front crankshaft bearing preventing weaving and eliminating oil leakages at the joint between the crankcase and the front nose section. The front nose section is a heat-treated magnesium casting and carries the valve tappets and guides, the cam drive gearing, oil take-off arrangement and operating valve for controllable propellers. The rear accessory case drive section comprises two heat-treated magnesium alloy castings providing the mountings for the driving gearing and various accessories.

The battery ignition engine provides two separate double breaker distributor systems incorporating automatic advance, which gives the correct retard for starting and idling and automatically advances the proper amount in relation to the engine speed. The units are packed with special lubricants and do not need any lubrication for 500 hours' service.

Valve tappets, push rods, rocker arms, rocker arm bearings and valve springs are enclosed and sealed.

Standard equipment on the L-5 battery ignition engine includes: two Bosch or Scintilla double breaker battery timers (either plain or radio shielded), two Bosch or Scintilla 12-volt coils (radio shielded), Eclipse Model 3171 15-ampere generator (radio shielded), with voltage regulator (radio shielded), Stromberg Type NAR-7A carburetor with a 2.125 venturi, Eclipse Model E-80 direct cranking electric starter and plain wiring with B. G. 4B2 Spark Plugs. Optional equipment: Breeze radio shielding, Eclipse Type G 15-ampere or Type D 25 ampere generators, Romec vacuum and fuel pumps.

Standard equipment on the magneto ignition engine includes: two Scintilla Type MN7-DF magnetos (plain or radio shielded), Stromberg NAR-7A carburetor with 2.125" venturi, plain wiring with B.G. 4B2 spark plugs. Optional equipment: Eclipse E-80 direct cranking electric starter, Eclipse Model 3171 15-ampere generator with control box, Eclipse Type G 15-ampere generator and control box, Eclipse Type D 25-ampere generator with control box, Eclipse vacuum pumps, Romec vacuum pumps, Romec fuel pumps and Breeze radio shielding harness.

Digest of Technical Articles from Foreign Publications

Parachutes

The Parachute (*Le Parachutism, par P. A. Richard, L'Aerophile, No.* 12, *Décembre,* 1935).

The author passes briefly over the recent history and technical development of the parachute and outlines the requirements which must be met by a modern parachute. He then outlines an elementary mathematical study of time, velocity and resistance in fall and describes the psychological and physiological effects on a jumper. In the section entitled *The Present Technique of the Parachute,* experimental data on resistances of different canopies are given with further information on the fall of a body in the atmosphere. Delayed opening is studied and an interesting series of charts is reproduced from Russian studies on times of descent and distances of fall. The article covers the effect of altitude and in general gives a comprehensive presentation of the problem.

Structures

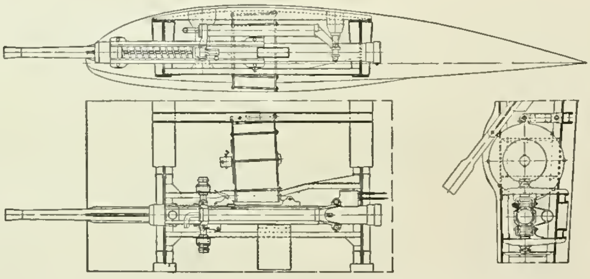
Stressed-Skin Structures, New Formulae for Calculating the Stability of a Monocoque in Compression, by J. Lockwood Taylor, D.Sc., A.M.I.N.A. Aircraft Engineering, No. 82, *December,* 1935.

One of the outstanding problems in design of stressed-skin structures is that of ensuring adequate rigidity to guard against instability failure or buckling of structural parts which have to carry compressive loads. Such structures consist usually of a series of longitudinal members or stringers with intersecting transverses or frames. Apart from the waving of the skin itself in the panels thus formed, which must usually be tolerated and which remains moderate in extent so long as the stiffening members themselves do not deflect, and does not impair the ability of the structure as a whole to continue to take increasing load, there are two possible forms of buckling. Stringers alone may bow between adjacent frames, which remain fixed, or longer waves involving both stringers and frames may occur. The second type of buckling may occur only in the case of insufficient rigidity of the frames. The article treats this latter case of form stability giving solutions for cases of flat and curved panels.

Armament

Oerlikon Repeating Cannon Model FF (*Oerlikon Mehrfach-Kanone Model FF, Flugsport XXVII Jahrgang Nz* 20, 2 *Okt.* 1935).

The article describes a new type of an aircraft repeating cannon of 20 mm. caliber. This cannon, manufactured by Oerlikon, a Swiss company, is intended for an installation where the line of fire is outside of the propeller disc. In its design the following desirable features were considered: wing installation with least possible change in airfoil outline, short barrel projection beyond the leading edge, lightness, and small recoil loads. The repeating type cannon Model FF of 20 mm. caliber, weighs 55 lbs. complete with charging unit; its overall length is 4.39 feet, muzzle velocity is 1968 ft./sec. and it fires 550 rounds per minute. The recoil load is 231.5 lbs. The flight tests of an experimental installation on a single seat fighter gave excellent results. The article contains outline drawings of the gun as well as sketches of typical wing installations.



Wing installation of Oerlikon 20 mm. caliber aircraft cannon

Wind Tunnel Tests

Results of Experiments of Aerodynamical Laboratory of the Royal Engineering Institute of Turin (*Rendiconti Sperimentali del Laboratorio di Aeronautica del R. Istituto Superiore di Ingegneria di Torino,* 2ª *Serie*)

L'Aerotecnica, Volume XV—N. 11-12, *Novembre-Dicembre* 1935.

The contents of the second report on results of experiments conducted in the Aerodynamical Laboratory of the Royal Engineering Institute of Turin are as follows: 1: Six-component balance. 2: 60-centimeter wind tunnel, free jet type with return conduit. Flow explorations for different arrangements of the fan-propeller and entrance cone. 3: Apparatus for electrical analogy. 4: Slotted wings of various forms and with and without ailerons. 5: Airplane model tests. 6: Landing gear tests with three different fairings. 7: Tests of tail surfaces in the presence of a running propeller. Experimental determination and theoretical analysis. 8: Automobile body tests. Air forces and moments on three models.

Ice Formation

On Ice Formation in Air Travel (Uber die Vereisung von Luftfahrzeugen, von H. Noth und W. Polte, Luftwissen, Bd. Z. No. 11, Seite 303-332, Nov. 1935.)

The authors feel that proper safeguards against ice formation should consist not only in mechanical means to combat ice once it is formed, but rather in correct interpretation of the meteorological conditions which are essential for ice formation. As the article states: "The major difficulty of bad weather flying is ice formation. There is a great deal written on the subject of ice formation and technical means for de-icing, but it is seldom that the results of practical experience are analyzed in this connection. This article presents the question of ice formation from viewpoints of a meteorologist and a pilot. Their experience indicates that the problem of ice formation is a problem of navigation and proper interpretation of weather conditions. With the proper knowledge and meteorological information the pilot in many instances may either completely avoid or lighten the degree of ice formation."

Structures

Great Circle Engineering, The Aeroplane, January 15, 1936. "Geodetic" Construction, by C. M. Poulsen, Flight, January 16, 1936.

Both these articles treat the subject of the new type of aircraft construction invented by B. N. Wallis and developed at the Weybridge Works of Vickers (Aviation) Ltd. The principle consists in building the primary structure as a series of interlaced members located at the extreme periphery of the form and disposed along the direction of principal stresses.

This part of the structure is assigned to take care of the torsional strength, the bending strength to be separately provided for by bending-resistant beams or appropriate trusses. The "geodetic" members are attached to the beam flanges (or upper truss members) at each intersection point. In order to obtain a smooth covering without flats of objectionable nature a series of stringers may be added for covering attachment.

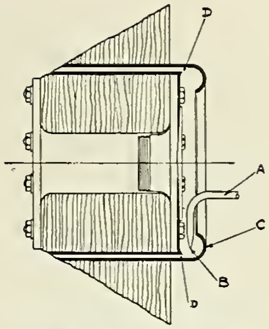
The structural advantages claimed for this new type of construction are greater rigidity, strength and weight saving.

Propellers

Tables for Use in an Improved Method of Airscrew Strip Theory Calculation. By C. N. H. Lock, M.A., and D. Yeatman, of the Aerodynamics Dept., N. P. L. Air Ministry (Great Britain) Aeronautical Research Committee Reports and Memoranda No. 1674, October 22, 1934.

In R. & M. 1377 and R. & M. 1521 a new method of calculating the performance of a propeller was described which represented an improvement on the standard vortex theory in so far as the latter assumes that the number of blades is infinite while the new method makes an allowance for tip loss which varies with the number of blades. The new method is based on calculations by Goldstein of the velocity field of rigid helicoidal surfaces moving through a perfect fluid. Goldstein's original numerical calculations were limited to two-bladed propellers of pitch ratio less than 1.5 and to a single four bladder. The calculations have now been extended to the case of four-bladed propellers and to higher pitch values; they are given in the present report in a form convenient for application to the propeller problem. By special methods of interpolation the results may be applied to any radius or number of blades for any value of pitch.

From a preliminary comparison between results of calculations and tests it is concluded that the present formulae and tables may be used with confidence to calculate the performance of any propeller below the stalling angle, provided that suitable airfoil data are available.



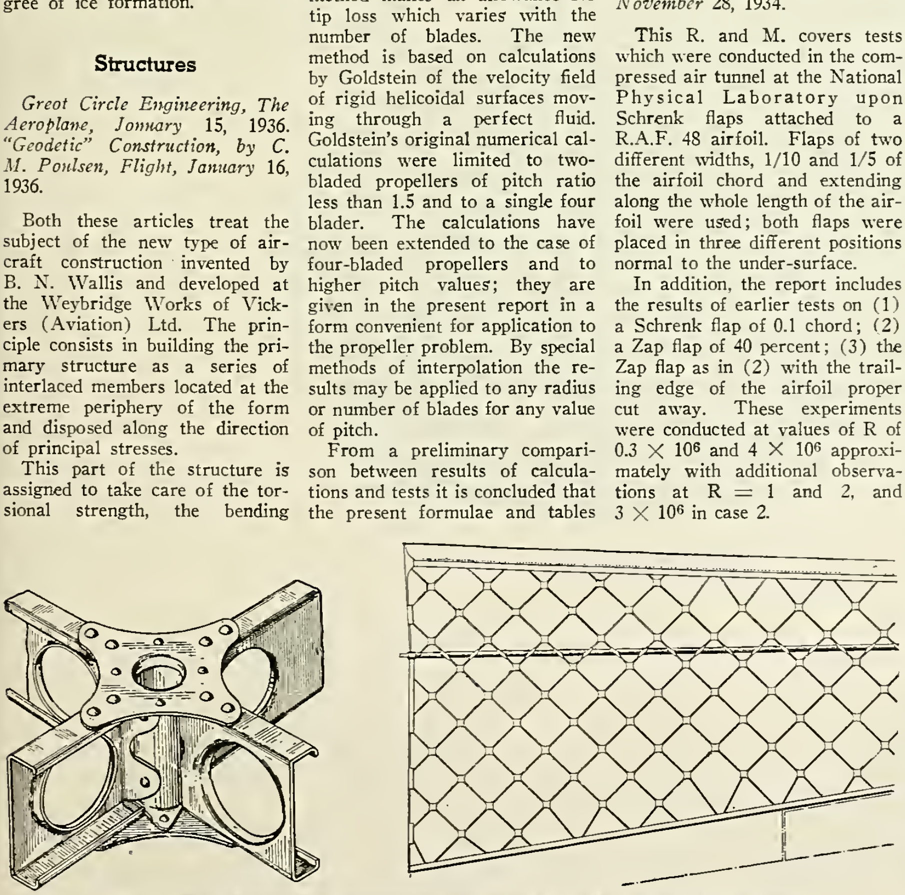
Chemical de-icer for propellers. A—supply tube. B—nozzle. C—distributor ring. D—outlets to blades

Flaps

Tests on Aerofoil Flaps in the Compressed Air Tunnel.—By R. Jones, D.Sc., A. H. Bell and E. Smyth, B.Sc., of the Aerodynamics Department, N. P. L., Air Ministry (Great Britain) Aeronautical Research Committee Reports and Memoranda No. 1636, November 28, 1934.

This R. and M. covers tests which were conducted in the compressed air tunnel at the National Physical Laboratory upon Schrenk flaps attached to a R.A.F. 48 airfoil. Flaps of two different widths, 1/10 and 1/5 of the airfoil chord and extending along the whole length of the airfoil were used; both flaps were placed in three different positions normal to the under-surface.

In addition, the report includes the results of earlier tests on (1) a Schrenk flap of 0.1 chord; (2) a Zap flap of 40 percent; (3) the Zap flap as in (2) with the trailing edge of the airfoil proper cut away. These experiments were conducted at values of R of 0.3×10^6 and 4×10^6 approximately with additional observations at R = 1 and 2, and 3×10^6 in case 2.



Plan view of geodetic wing construction and detail of geodetic members' intersection

De-Icers

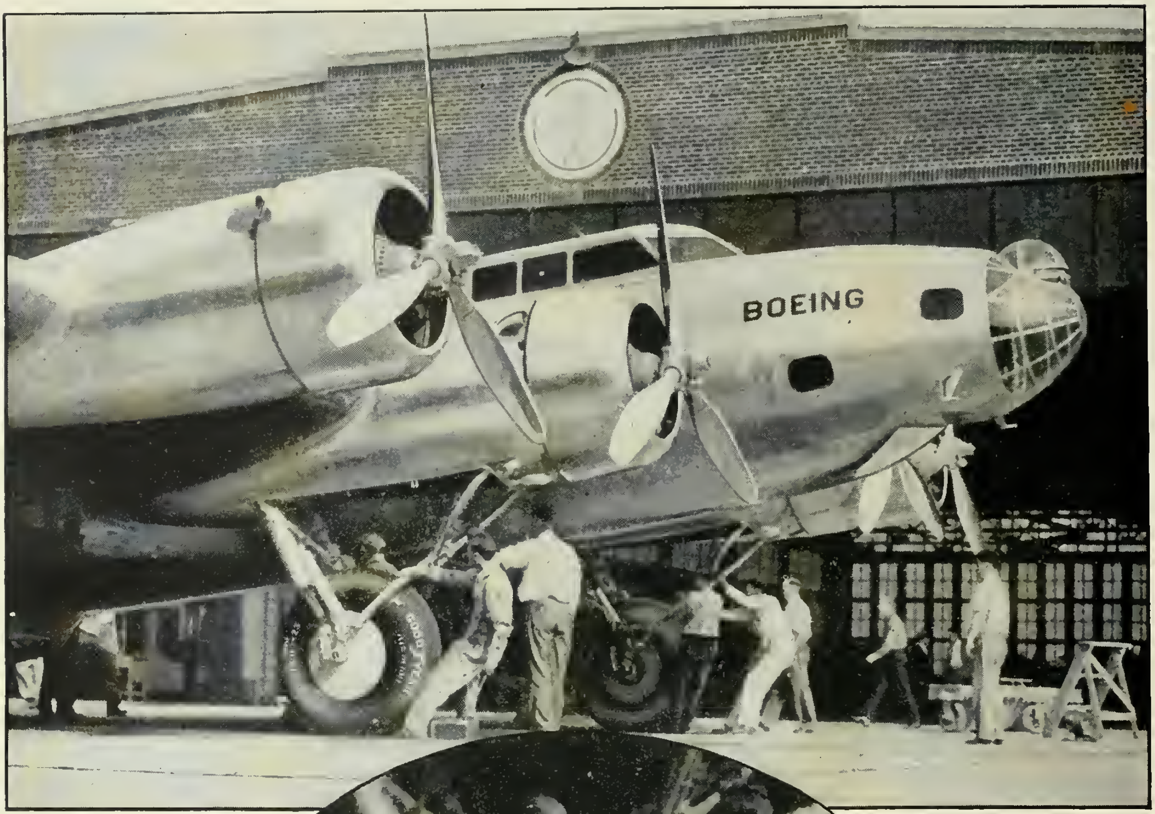
The Prevention of Ice Accretion, by B. Lockspeiser, M.A., The Journal of The Royal Aeronautical Society, No. 301, January, 1936.

In the beginning of this paper the author treats the subject of meteorological conditions favorable to ice formation. Next he discusses three possible methods whereby the formation of ice on airplanes may be prevented. These methods are: (a) thermal; (b) mechanical; and (c) chemical. The author does not hold out much hope for the thermal method in present aircraft, but qualifies his statement with a remark that in the aircraft of the future the ice problem may be solved along these lines. He then describes the mechanical de-icer based on pulsating effect of the inflatable rubber tubes located at the leading edge of the wings and tail surfaces and extensively used in U. S. A. The chemical method is considered by the author as the lightest of the three and inherently simpler to install. An application of the chemical method for propellers is described, the liquid used being ethylene glycol.

Turbulence

The Theory of Turbulence, Momentum Transfer and Interchange of Vorticity (La Teoria della Turbolenza ed il Trasporto della Quantita di Moto e della Vorticita, C. Ferrari, L'Aerotecnica, Volume XV—N. 11-12. Novembre-Dicembre, 1935).

The author studies the problem of momentum transfer and interchange of vorticity based on theories of Taylor and Prandtl. A brief summary of both theories is given. He shows how the formulae obtained by Prandtl can be brought into accord with the experimental data for all such cases which conform with the principle of Th. von Karman's similarity hypothesis. This is particularly true as regards the distribution of velocities and temperatures in the wake of a heated cylinder. Limitations of the formulae are shown for the case of a slightly curved flow. Mattioli's theory is investigated and it appears to be conducive to some observations. The author concludes that it appears difficult to obtain a satisfactory turbulence theory based on transfer principle and deduced by the method of classical mechanics. Having shown the limitations of these methods, he presents the theory of Gebelein based on the methods of statistical mechanics.



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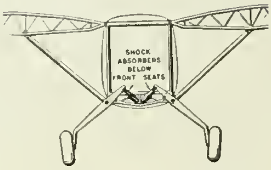
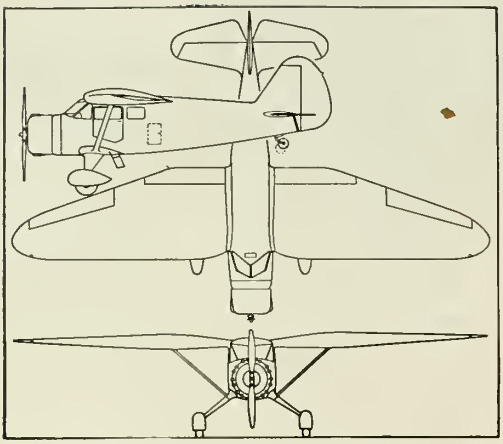
IN RUBBER

YEAR

Standard and Long Range
STINSON RELIANT
Models SR7-A and SR7-B

●





● The 1936 Stinson Reliant, recently put into production by the Stinson Aircraft Corp., is an improved and faster version of the 1935 model.

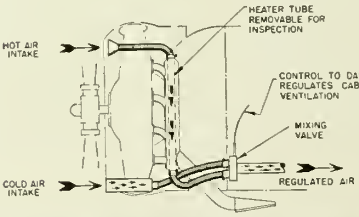
While it is somewhat similar in appearance to its predecessor, the new Reliant, which is available in special and standard models, is more economical to operate and incorporates vacuum operated flaps with slots which enable slower and steeper landing glides with less run after the plane is landed.

The standard job, known as the SR7-A and the special model, known as the SR7-B are identical in appearance and construction, with the exception that the special model is equipped with a Lycoming controllable pitch propeller, additional fuel tankage, special leather upholstery and colors, and a more powerful engine.

Construction of the fuselage is of welded steel tubing, fabric covered. Seats are arranged in tandem, the rear seats being of the "form fitting" type. Pilots seats are adjustable, fore and aft and have folding backs, and arm rests are provided for the pilot and co-pilot as well as the two passengers. All seats are upholstered in Spanish tan leather in the standard model, with four shades of special leather available for choice on the SR7-B. Cabin trim includes a recessed, walnut grained instrument panel, taupe side walls, map pockets, ash receivers, assist cords, rear cabin side lights and carpeted floor.

Windows are operated with automobile-type regulators and are of safety glass. No draft ventilation is provided in the rear windows. The windshield is the transport V-type, providing in the 1936 series greater visibility because of its enlarged size. Windshield glass is mounted in Alumalastic to eliminate drafts and moisture and each front side quarter remains clear in wet weather. Baggage allowance and space have been increased, space being provided under the rear seats for full-sized Gladstone bags. Additional baggage space is provided in another compartment, accessible from a door on the outside and equipped with lighting facilities.

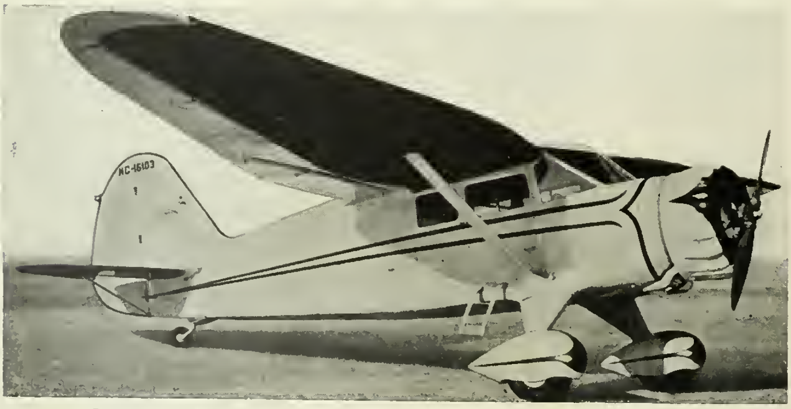
Ventilation is controllable. Air used for heating or ventilation is taken from in front of the engine to eliminate oil fumes and insure pure air. The air is then forced through large ducts which carry it to the front and rear of the cabin. A heater tube has been placed in the exhaust and this may be easily and quickly removed for inspection. When the plane is being operated in warm climates, this unit can be eliminated.


HEATER TUBE REMOVABLE FOR INSPECTION
HOT AIR INTAKE
CONTROL TO DASH, REGULATES CABIN VENTILATION
MIXING VALVE
COLD AIR INTAKE
REGULATED AIR

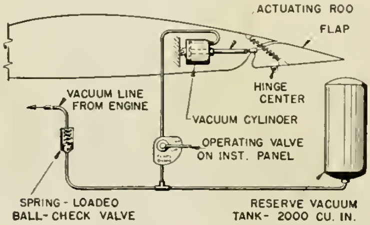
As in the 1935 models, Stinson engineers have eliminated the space occupying control column on which the wheel was mounted. Instead appearance has been improved and more room provided by the use of auto-type dual controls which protrude from the dash and remove all obstruction from the center of the cockpit. The unit on the right is removable. Instruments have been mounted in an indirectly lighted, rubber insulated panel which is equipped with Kollsman compass, airspeed indicator, tachometer, altimeter, oil pressure and oil temperature gauges. Combined rudder and brake pedals are provided. Brakes are operated by depressing the heel on the pedal, while the rudder is controlled with a forward motion of either foot. Brakes are made of a series of copper and steel discs actuated by hydraulic action.

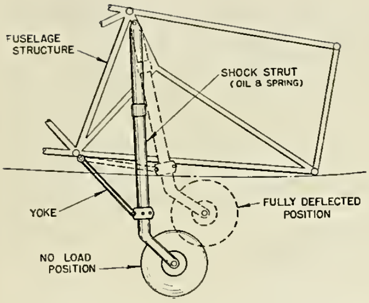
Entrance to the cabin is by a steel tube step on each side through two large doors.

Wing structure is of the gull type with the entire construction of metal, with fabric covering. Spars are of welded chrome molybdenum steel tubing and ribs are riveted dural tubing of square section with dural gussets. Flaps are of the trailing edge type of riveted dural covered with fabric. Operation of the flaps is obtained by vacuum cylinders with a reserve tank to automatically insure operation. A vacuum line, lead from the engine and a 2000 cu. in. reserve tank provide ample and constant source of power.



Lycoming-powered Stinson Reliant for 1936 with accommodations for four


ACTUATING ROD
FLAP
HINGE CENTER
VACUUM LINE FROM ENGINE
VACUUM CYLINDER
OPERATING VALVE ON INST. PANEL
SPRING - LOADED BALL - CHECK VALVE
RESERVE VACUUM TANK - 2000 CU. IN.



A wide tread, cantilever type landing gear with 8.50 × 10 low-pressure Goodyear tires, is provided on the Reliant. This gear is hinged at the lower corners of the fuselage, with the inner ends of the beams attached to Cleveland Pneumatic Aerol shock absorbers. Metal pants or mud guards are optional equipment.

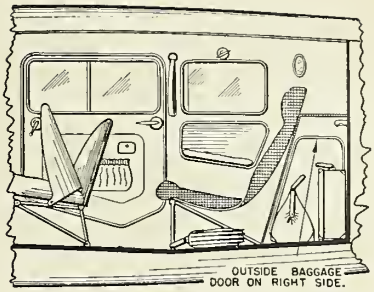
The tail wheel is a double action fully swiveling unit equipped with a 10 × 5 streamlined Goodyear pneumatic tire and a long-stroke shock absorber. The wheel is so hinged that shocks and landing loads are taken with a backward as well as an upward movement which decreases shocks to rear end parts and also improves riding comfort when taxiing.

The standard model SR7-A is equipped with an adjustable pitch Hamilton Standard metal propeller driven by a 225 h.p. Lycoming R680-4 engine enclosed in a full NACA cowl. A Lycoming R680-6 engine of 245 h.p. is used to power the SR7-B.

Standard equipment on both models includes Bauer & Black first aid kit, Eclipse direct drive starter and booster coil, cabin heater, Pyrene fire extinguisher, 35 ampere hour Exide storage battery, Grimes navigation lights and Fafnir ball bearings for plane and engine controls. Color on the SR7-A is black for the fuselage with silver on the wings and the stripes set off by a red pin stripe.

Specifications

Wing span	41 feet 7.25 inches
Overall length	26 feet 8.81 inches
Overall height	8 feet 6 inches
Wing area	256.5 square feet



	SR7-A	SR7-B
Engine Lycoming	R680-4	R680-6
Horsepower	225	245
Empty weight (lbs.)	2260	2310
Useful load (lbs.)	1115	1290
Payload (lbs.)	615	662
Gross weight (lbs.)	3375	3600
Baggage (lbs.)	105	152
Fuel capacity (gals.)	50	70
Oil capacity (gals.)	4	5
Maximum speed (m.p.h.)	148	150
Cruising speed (m.p.h.)	138.5	141
Landing speed (with flaps) (m.p.h.)	48	50
Landing speed (no flaps) (m.p.h.)	55	57
Service ceiling (feet)	12,800	14,600
Rate of climb (ft./m.)	715	850
Cruising range (miles)	400	560

Recent Aeronautical Patents

The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Engine starting mechanism. Bascom Smith, East Orange, N. J., assignor to Eclipse Aviation Corp. (2,025,910)

Means for preventing accumulation of ice on airplanes or like. Harry E. Waner, Akron, Ohio, assignor to B. F. Goodrich Co. (2,025,919)

Supercharger fuel drain. Arthur H. Leak, Ramsey, N. J., assignor to Reed Propeller Co. (2,026,182)

Engine starting mechanism. Raymond P. Lansing, Montclair, N. J., assignor to Eclipse Aviation Corp. (2,026,281)

Parachute pack release mechanism. Leslie L. Irvin, Letchworth, Herts, England, assignor to Irving Airchute Co., Buffalo, N. Y. (2,026,314)

Control for aerofoils, etc. Glan D. Mattioli, Padoa, Italy. (2,026,482)

Navigational instrument and noon interval calculator. Henry M. Jensen, Captain, U. S. Navy. (2,026,537 and 2,026,538)

Airfoil construction. George E. Barnhardt, Pasadena, Calif. (2,026,727 and 2,026,728)

Propeller control mechanism. Frank W. Caldwell, West Hartford, and Erie Martin, Hartford, Conn., assignors to United Aircraft Corp. (2,026,814)

Aircraft. Robert H. Goddard, Roswell, N. Mex. (2,026,885)

Inclinometer. Clair W. Hudlow, Washington, D. C. (2,026,895)

Propelling device (aircraft propeller type). Earl H. Smith, Flushing, N. Y. (2,026,917)

Landing apparatus for airplanes. Julius Goldman, Los Angeles, Calif. (2,027,162)

Aircraft wheel brake. Frederick J. Tarris, Silvertown, London, England, assignor to India Rubber, Gutta Percha and Telegraph Works Co. Ltd., Aldwych, London. (2,027,210)

Heat exchange apparatus (for aircraft). Darragh L. Higgins. Denham, Mass., assignor to B. F. Sturtevant Co. (2,027,315)

Sighting control for aircraft, range finding and flight directing apparatus for use in aircraft, and apparatus for use in directing the flight of aircraft. Alexander Procofieff-Seversky, New York, N. Y., assignor to Seversky Aircraft Corp. (2,027,348; 2,027,349, and 2,027,350)

Supercharging of power plant. John Pavlecka, Detroit, Mich. (2,022,900)

Navigational instrument. Robert W. Bockius, U. S. Navy. (2,027,368)

Propeller mounting mechanism. Frank A. King, Los Angeles, Calif. (2,027,439)

Navigational guide systems. John H. Hammond, Jr., Gloucester, Mass. (2,027,527, 2,027,528, 2,027,529, and 2,027,530)

Driving mechanism for propellers. Samuel K. Hoffman and Samuel K. Wiegman, Williamsport, Pa., assignors to Lycoming Mfg. Co. (2,027,592)

Wind-angle indicator. Albert R. Pierce, Jr., New Bedford, Mass. (2,027,613)

Spar structure. Wilson L. Sutton, Long Island, N. Y., assignor to Fleetwings, Inc. (2,027,711)

Synchronizing device for machine guns on aircraft. Jan Szal, Warsaw, Poland. (2,027,755)

Artificial horizon for aircraft. Bert G. Carlson, Queens Village, N. Y., assignor to Sperry Gyroscope Co. (2,027,808)

Landing gear for airplanes. William A. Crossley, Philadelphia, Pa. (2,027,960)

Apparatus for balancing propeller blades. John Squiers, Hagerstown, Md. (2,028,254)

Change pitch propeller. George F. McDougall, Portland, Ore. (2,028,463)

Ice removing means. Thorp Hiscock, Seattle, Wash., assignor to United Air Lines Transport Corp., Chicago, Ill. (2,028,669)

Airport control and signaling system. Laurence J. Lesh, Chicago, Ill., assignor to Associated Electric Laboratories, Inc. (2,028,722)

Parachute construction. Edward L. Hoffman, Dayton, Ohio. (2,028,777)

Cellular bottom construction for boat bodies of hydroairplanes, honeycomb construction for aircraft, honeycomb wing construction for airplanes, and cellular construction for aircraft pontoons. Harry N. Atwood, South Lyndeboro, N. H. (2,029,047; 2,029,213; 2,029,214, and 2,029,215)

Flying boat suspension structure. Earl J. W. Ragsdale, Norristown, Pa., assignor to Edward G. Budd Mfg. Co., Philadelphia, Pa. (2,029,276)

Automatic change pitch propeller. Charles Peterson, Iron Mountain, Mich. (2,029,503)

Inclination responsive device for aircraft. Johann M. Boykow, Berlin - Lichterfelde - West, Germany. (2,029,700)

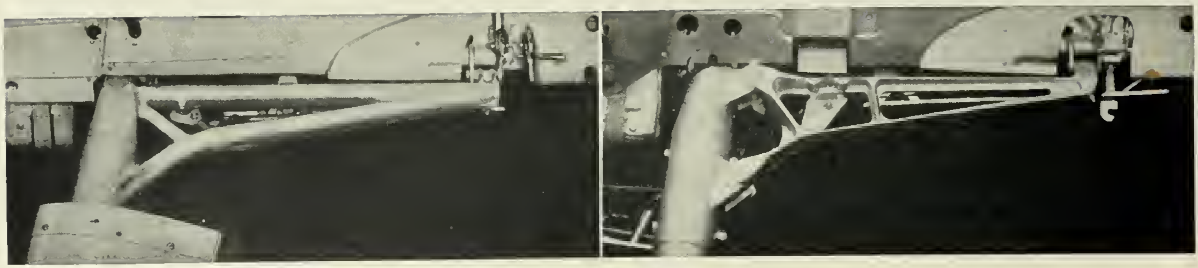
Inclinometer. Floyd L. Martin, Laona, Wis. (2,030,068)

Helicopter. Sidney P. Vaughn, U. S. Navy. (2,030,078)

Retractable landing gear for geared propeller airplanes. John F. Haberlin, Seattle, Wash., assignor to Boeing Airplane Co. (2,030,293)

Aircraft. Anton Flettner, Berlin, Germany. (2,030,578)

Variable pitch propeller. Frank Gorski, Portland, Ore. (2,030,-



Upper end of landing gear strut showing (left) welded bracing structure; (right) modification utilizing forged unit

Use of Forgings in Modern Aircraft

●

P. N. JANSEN

Factory Manager, Curtiss Aeroplane & Motor Co.

● For many years a few miscellaneous forgings were used in aircraft but they were rather the exception than the rule. However, the increasing use of all-metal construction, retractable landing gears, greater power with the demand for greater speed in recent years have brought about new material requirements and the introduction of new materials went hand in hand with improved designs.

In 1933, Curtiss Aeroplane & Motor Co. adopted the policy of using steel and aluminum alloy forgings wherever possible. In some cases new designs demanded forgings; in many more cases forgings were introduced where previously built-up, welded and riveted fittings had been used.

In each change from a built-up fitting or casting an estimate was made of the increase or decrease in weight and cost including forging dies, machine tools, etc. In this preliminary undertaking, forge shops were called on and they assisted materially in the design of forgings and die cost estimates. A set of rules was established whereby highly stressed fittings, which showed improvement in strength and durability by the use of forgings were adopted despite their higher cost—all other fittings were figured on a dollars and cents basis.

On the first order of Curtiss airplanes in which forgings were extensively used, about 80 different fittings were considered, of which 65 showed an appreciable saving in favor of forgings. On a recent order for a large number of airplanes, 130 different forgings were used, equally divided between steel and aluminum alloy.

The extensive use of forgings in place of built-up fittings introduced radical changes in manufacturing processes. A sheet metal fitting can be made in a small shop with comparatively little equipment. Most forgings require accurate machining with carefully planned and designed tools and jigs used in conjunction with modern machines. Whereas a sheet metal fitting may be left large for trimming, a drop forging must be to size. Since weight saving is of extreme importance in airplane parts, forging tolerances are smaller than most forge shops admit they can hold. With the outside dimensions of the forgings held so close, locating fixtures for milling, boring and drilling must be of good design and of accurate build.

Aluminum alloy forgings are heat-treated to a tensile strength of 55,000 lbs./sq. in. (minimum). They are etched after heat-treatment and inspected for cracks and defects prior to machining.

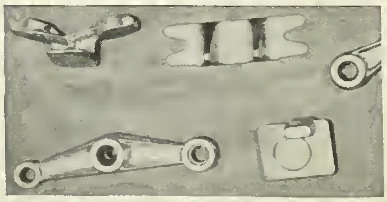
Practically all steel forgings are made from X-4130 chrome molybdenum and these undergo considerably more inspection than the aluminum alloy forgings. The forgings are received in the annealed state. Small forgings with no great amount of machining are immediately normalized prior to machining and then heat-treated after rough machining. Heat-treats range between 125,000 to 180,000 lbs./sq. in.

Large forgings requiring removal of a great amount of material are partially machined in the annealed state, then normalized, and then heat-treated in a semi-finished state. They are then returned for final machining.

Introduction of forgings also brought about new inspection problems. An accurate inspection for defects and cracks is obtained through the magnaflux system. All forgings go through this process once; large pieces go through more than once during the machining operations. The forgings are magnetized and dipped in a petroleum solution containing a metal powder. Any defects on the surface or slightly below are discovered by a telltale deposit of the powder on the defect. When it appears that the defect will be machined out, such forgings are tagged and after rough machining are rechecked by the same method. Any defects that cannot be removed before or after preliminary machining are rejected.

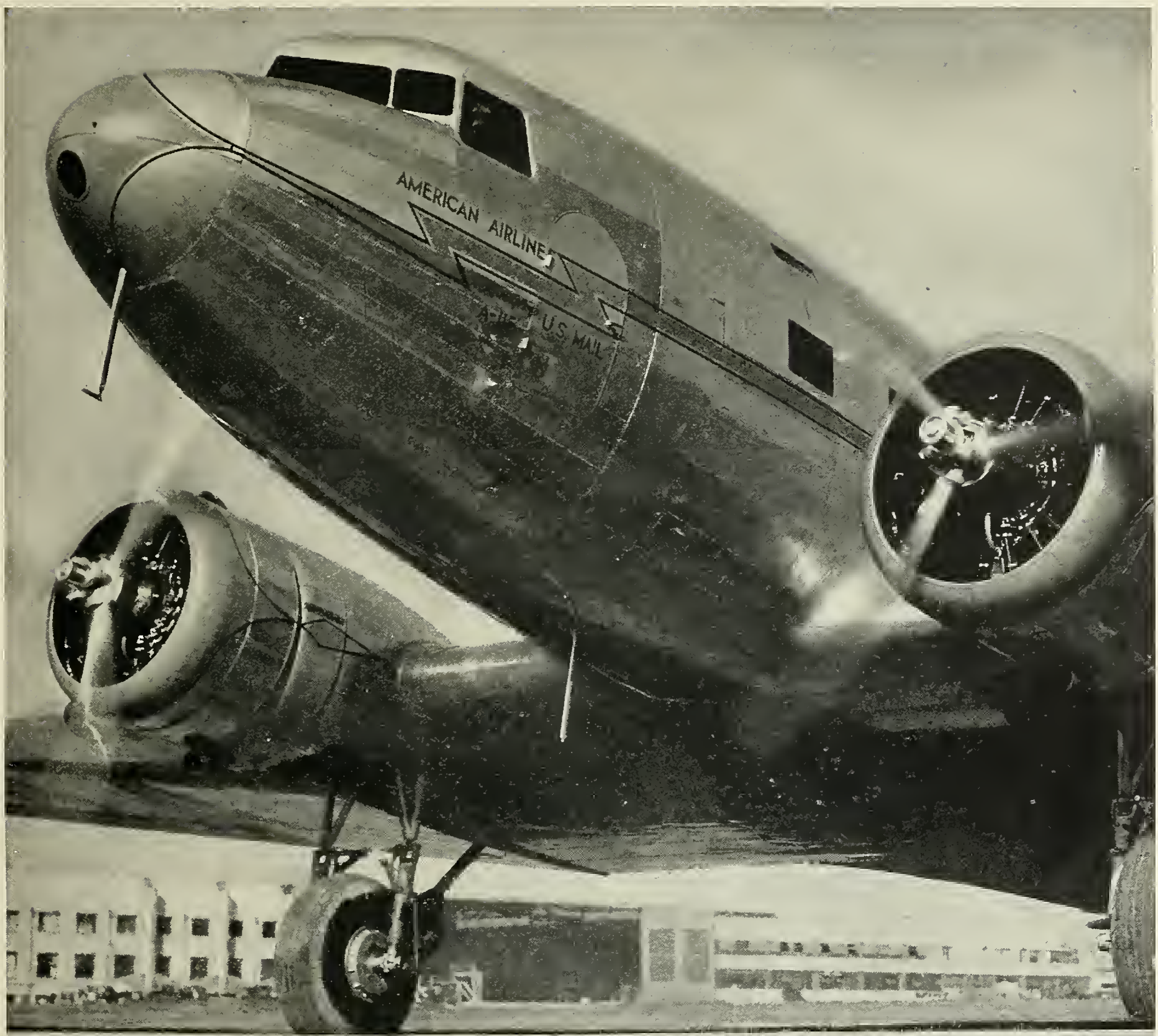
With the use of forgings in production quantities of airplanes, Curtiss Aeroplane has adopted a policy of using as many as practical on its latest experimental models. This eliminates redesigning for production and puts the experimental article through its test with the advantages of a production airplane.

Since experimental airplanes are usually built singly and some changes during construction are necessary, no great amount of money is spent on dies, jigs and fixtures. Instead, hand forgings are obtained or bar stock is used. Irregular shapes are hand forged with consideration for grain flow and the more normal pieces are machined from bar stock. Machining is accomplished by set-ups aided by the use of standard tools and whatever fixtures may be adopted from previous contracts.



Miscellaneous dural forgings

Rough and machined oleo forgings



Constant Speed Control *standard equipment on*

New Douglas Sleeper

This first transport to be designed specifically for sleeper service is attracting world-wide attention. As on other noteworthy military and commercial airplanes to make their bow during 1936, Hamilton Standard's latest development, Constant Speed Control, has been adopted as standard equipment.

HAMILTON STANDARD PROPELLERS
East Hartford, Connecticut
Division of UNITED AIRCRAFT MANUFACTURING CORPORATION

The New Cub Monoplane

● The New Cub J2, a high-wing two-place open or closed monoplane, has recently been completed and flown by the Taylor Aircraft Corp. Improving on its predecessor, the 1936 Cub shows constructional refinements in fuselage, landing gear, wings, and tail surfaces, and increases in overall length and height.

The fuselage, from front to rear approaches true streamline form. The angle between the windshield and the airstream has been lowered, thus enhancing visibility and decreasing resistance. In the rear, the fuselage fairs into the wing to further carry out the streamline design.

Construction of the fuselage follows closed cockpit design, giving a roomy cabin and space for baggage, accessible from the cabin. The plane may be converted into an open model by removing the side windows. Steel tubing with a modified Warren truss type structure is employed. Chrome molybdenum is used for the front half of the fuselage including the wing struts and rear landing gear fittings, as well as for the detachable engine mount. Carbon steel is utilized aft of the cockpit to the tail post.

Wing tips have been rounded and the wing itself constructed in two panels using a U.S.A. 35B airfoil section. Each wing is formed by 12 ribs and a similar number of false ribs mounted on two spruce spars. Ribs are of the truss type stamped and riveted from sheet aluminum alloy.

Drag truss bracing consists of 5 compression struts of .035 gauge, 1025 steel tubing and nickel steel tie rods. The leading edge is covered with sheet Nicral and the curved ends of the wings are formed by ash wing bows. V type external wing bracing consists of two streamlined struts on each side of fuselage, extending from and attached to the lower fuselage longeron. Two vertical struts between the wing and V are provided for additional rigidity. Ailerons are of the inset type, formed in a combination of steel tubing and Nicral and hinged to the butt plates with piano type hinges.

Tail surfaces have been redesigned so that the fin and rudder blend into the fuselage, and elevators and stabilizer curve to form an eclipse. All are of steel tubing with sheet steel bracing of box section. The stabilizer is adjustable from either seat in the cockpit. Horizontal tail surfaces are braced by wires attaching to the rear beams of the fin and stabilizer and lower longeron.

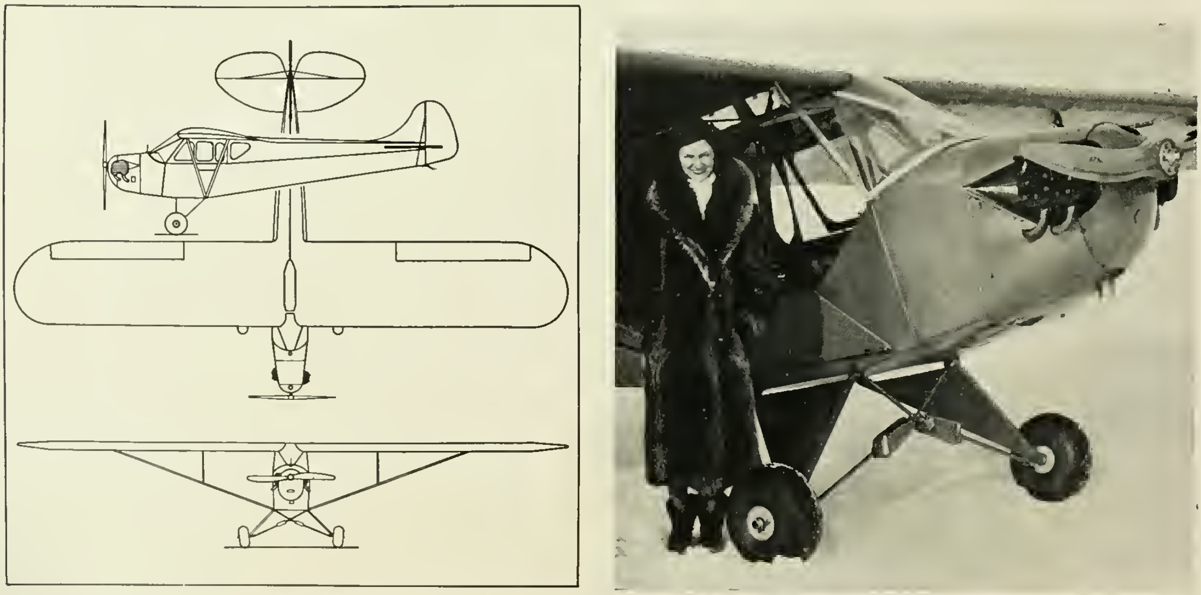
The landing gear is of the split axle, shock cord type and has a 72-in. tread.

Power is supplied by a 37 h.p. Continental A-40-3 engine equipped with a Sensenich propeller. Tankage is provided for 9 gallons of fuel sufficient for a range of 210 miles at cruising speed. 1 gallon of oil is retained in the sump of the engine.

In standard colors, the wing and fuselage are finished in opalescent copper. Engine cowling, lettering and striping are in opalescent green. Black and yellow are alternative standard color combinations. The interior of the cabin is finished in the same colors as the outside and black leather seat cushions are provided.

Specifications and performances of the New Cub are as follows:

Wing span	35 feet 2 inches
Overall length	22 feet 5 inches
Overall height	6 feet 8 inches
Wing area	178.5 square feet
Wing loading	5.44 lbs./sq. ft.
Power loading	25.5 pounds per h.p.
Fuel capacity	9 gallons
Oil capacity	1 gallon
Empty weight	563 pounds
Useful load	407 pounds
Payload	175 pounds
Gross weight	970 pounds
Maximum speed (sea level)	87 m. p. h.
Cruising speed	70 miles per hour
Landing speed	30 miles per hour
Rate of climb	450 feet per minute
Cruising range	210 miles



Outline drawings and a close up of the New Cub convertible two-place monoplane

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EQUIPMENT and METHODS

●

Air Conditioning Transports

Greater comfort on TWA Douglas DC-2's, both for passengers and crews is being obtained from new air conditioning devices which have been put into use at many points along the company's coast-to-coast route. These devices are produced by Caldwell & Associates, who developed them in conjunction with TWA.

Each of these devices is intended for the purpose of making aircraft cabins more comfortable from the standpoint of temperature while planes are on the ground. This applies both to summer and winter, since the conditioners keep interiors cool in the summer and warm in winter.

Developed at the Kansas City headquarters of TWA, the new unit is converted for winter use by heating the brine ordinarily used in cooling to a temperature of 210°. The degree of heat sent into the airplane may be regulated and comfortable temperatures easily produced.

The conditioner is in a large, oblong case, mounted on rubber-tired wheels. It is connected to the plane by a flexible hose through which warm or cool air, depending upon the season, is sent into the machine.

In the winter time, its effect is to maintain warmth within airplane cabins until the plane's engines have been started and the thermostatically controlled steam heaters have started functioning. In hot weather, it creates and maintains cool temperatures until the airliners have taken off and climbed into cooler air.

Engine Fire Extinguisher

Walter Kidde & Company, Inc., has developed a fire extinguishing system called *Lux*, which is especially adapted to engine protection for airplanes either in flight or on the ground. This extinguisher uses carbon dioxide, an inert gas that is instantly effective. Instead of fighting the slipstream, the Lux extinguisher makes use of it.

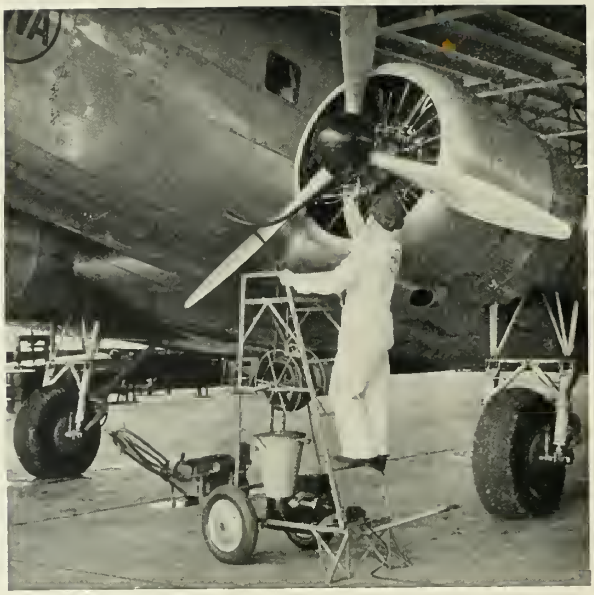
Discharged under 850 lbs. pressure and expanding in all directions, gas envelops the entire engine in a fire-killing cloud. Driven into every crack and crevice of the engine and under the cowling by the slipstream, it puts out the flames instantly.

The extinguisher consists of three major parts; the gas cylinder, the control, and the distributing piping. The gas cylinder is usually installed in back of the fire bulkhead. The control is mounted on the instrument panel convenient to the pilot and is connected with the valve on the cylinder by flexible cable run in ¼-in. aluminum tubing. The distributing piping is duralumin tubing installed in a perforated ring around the engine with a loop about the carburetor and an outlet in the carburetor intake. On multi-motored planes a direction valve to discharge the gas to the proper engine is incorporated in the control.

A pull on the control releases the extinguisher. This action operates a cutter in the valve on the cylinder and cuts out a non-corrosive metal disc which seals the gas in the cylinder. The gas discharges under the pressure of its own expansion and extinguishes the fire within three seconds.

The cylinder requires recharging only after use for the gas will not deteriorate with age or freeze at any temperature above —110° F. A signal on the valve gives visual indication of operation.

The cylinder is of high tensile strength steel machined to reduce weight. Other major parts are of aluminum or aluminum alloys.


Alemite electric lubricator powergun in use at Port Columbus

If desired, operation of the extinguisher can be made automatic in conjunction with the Lux Airplane Engine Fire Detector. The fire detector is non-electric and entirely self-contained. It consists of an indicator usually installed on the instrument panel and heat sensitive Luxstats mounted about the engine. The Luxstats are connected with the indicator by a common line of aluminum tubing. On multi-motored planes a complete detector is installed for each engine.

The Luxstats are operated by flame as well as by heat (250°). When operated, a Luxstat generates pressure that is transmitted through the tubing to the indicator on the instrument panel where it flashes a red signal. If an electric alarm is used in conjunction with the visual signal, the pressure also operates it.

The installation of a detector and an extinguisher eliminates the dangers of engine fires. The detector warns the pilot of the first flash of flame. The extinguisher makes it possible for him to snuff out the fire instantly. If desired, the detector and extinguisher can be combined to operate automatically.

Time-Saving Lubricator

One of the guarantors of on-time schedules for TWA is Alemite's HR-32 electric lubrication powergun, called the *Rock Crusher*.

TWA planes pause at Port Columbus for ten minutes in which time the plane must be refueled, lubricated, and checked for water in the cabin heating unit.

With the purchase of Alemite's HR-32, C. F. DeVoe, field manager at Columbus, saw possibilities for cutting lubrication time to the minimum. Around this unit he constructed a carriage of aircraft tubing, 6 ft. high with a ladder mounted on one side. Two reels carry electric cords for the powergun and a trouble lamp. The platform rolls along on a discarded landing gear.

As the Douglas begins its descent, the perambulator is hooked on the back of a truck and speeds across the tarmac, electric cord unreeling behind. When the plane finally stops, the mechanic climbs up the device and fills the three-bladed propellers with lubricant. Each blade bearing holds one pound of lubricant injected through a push type fitting. The *Rock Crusher* hose has a special push type nozzle machined out and fitted with a needle point valve. Back pressure automatically shuts off the flow when the bearing is full. (For controllable-pitch propellers an SAE 250 Gear Lubricant is used in summer; castor oil in winter.)

The hollow tube construction of the lubricating carriage keeps what lubricant remains in the 20-ft. hose from dripping to the ground. After lubricating the propeller bearing the hose nozzle is placed in the open end of a tube at the top of the carriage. The tube then drains excess lubricant back to the HR-32 tank where it is kept from congealing by a heating element.

Skiis For Aircraft

Department of Commerce approval on four new models of airplane skiis has been granted to Washington Aircraft and Transport Corp., at Boeing Field, Seattle. Eight sizes will be engineered before the series is complete.

While designed at the request of Alaska pilots, and constructed to meet specific operating conditions in that country, the design and engineering of the skiis are attributed to Lieut. A. Elliott Merrill, president of the company, and N. D. Showalter, Jr., chief engineer.

Pedestals are of welded steel tubing. Spruce or oak skiis are optional in every model, and may be had with or without metal bottoms. With the Department of Commerce approval, production has commenced on models for 2600, 3600, 4600, and 5600 lbs. gross load.

Shop Knife

Bonney Forge & Tool Works, Allentown, Pa., is marketing a strong, light and balanced shop knife which has six blades contained in its handle. This tool is useful for trimming upholstery, floor or running board mats, top-material, cutting gaskets, shims, kick boards, cardboard and for scraping off windshield stickers.

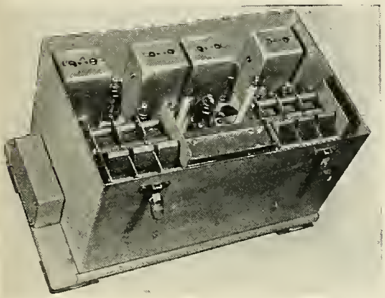
Protective Coatings

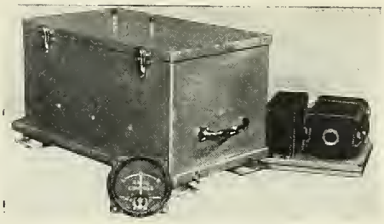
Technical Coatings, Inc., New York, is producing a line of new coatings which are asserted to form films which are free from porosity and impervious to water and corrosive atmospheric gasses. The vehicle or base is described as a combination of pure vegetable gums and heat-treated oils. It contains no linseed oil or synthetic resins. It forms films which are airtight and watertight, which are elastic and which produce hard films that will not peel, chip, or crack. For this reason they are of protective value in preventing corrosion of metals. They are applicable also to wood and to other surfaces.

Primers with the non-porous base are available for various purposes. Metallic zinc is good on black and galvanized surfaces and where salt-water exposure is severe. A combination of zinc and aluminum is recommended for fresh-water and humid conditions or where condensation occurs. A balanced red-lead, which is held in suspension permanently, is used as a primer for average conditions. Finishing coats in standard colors are also available, as is a high-gloss, acid-resistant grey. A vehicle for aluminum which requires 25% less aluminum powder than other vehicles, is also employed for finishing coats.

Application is by brush, spray or dipping, as preferred, after thinning with pure turpentine or high-grade mineral spirits. No linseed or other oil must be added, as this defeats the purpose of the non-porous base. Drying time varies from 4 to 16 hours, depending upon conditions.

Steinhoff Course Indicator





Steinhoff radio-navigator

The Steinhoff Course Indicator, a simplified radio-navigation instrument, is now being produced by Steinhoff Aircraft Radio Co.

This unit performs its primary function as a course indicator in either of two ways: as a visual beacon indicator, showing on a center scale meter the course on and off the beam; and, in conjunction with the same meter, as a broadcast station indicator, showing on and off the course to the broadcast station attuned.

A secondary function of the indicator performed in conjunction with a magnetic or gyro compass is that of position indicator by plotting on a chart, cross bearings of any two signal sources, beacon or broadcast.

Further, the Steinhoff indicator has possibilities as a controlling device in maneuvers, by enabling planes flying in formation through a fog or smoke screen, to maintain positions relative to a leading plane equipped with a transmitter.

There are two radio receivers in the Steinhoff unit, both constructed in one unit, with the tuning condensers of each mechanically coupled together.

Each receiver employs an automatic volume control circuit (a.v.c.) which increases the grid bias of the radio frequency tubes, with an increase in carrier current to the receivers. This action decreases the plate current of the tubes.

Two directional antennae are fixed in a streamlined V-formation and placed on the ship so that the fore-and-aft midship line bisects the angle. When the ship is headed directly toward or away from the received station, each antenna receives the same amount of signal; a deviation from course produces a greater signal strength in one or the other antenna.

Operating on the carrier current of a broadcast signal, a zero center scale meter is connected across two resistors, each of which is connected in series with the power supply and the plates of the r.f. tubes, controlled by the a.v.c. action, in one receiver.

With the plane going directly toward or away from the station the amount of signal input to each receiver is the same, therefore the plate current of the r.f. tubes is the same and no current will flow across the two resistors, and the meter will indicate zero in the center. When the ship deviates from the course, one antenna receives more signal than the other, a potential develops across the two resistors, the polarity of which depends on whichever receiver input is the greater. The meter indicates left or right according to the polarity of the current across the resistors and the greater the difference of the input currents, the greater the meter needle will deflect.

A variable shunt controls sensitivity of the meter. A control is also provided to balance the gain of the two receivers each time after tuning in a station; when turning the control a relay automatically connects the input of each receiver to the other, so that when the meter reads zero the two receivers are perfectly balanced.

A switch is used to change the tuning range of the receivers from one band to another. When this switch is set at beacon position, it grounds out the a.v.c. action and connects the meter so as to measure the audio output difference between the two receivers to provide a visual beacon indicator. The output of each receiver is rectified so that the meter needle will pulsate according to the audio note, created by the double beam transmitter. As the on-course signal is a constant note, the meter needle will not pulsate. Off-course, the signal from one beam becomes more predominant than the other, causing the needle to pulsate to the left or right, indicating the location of the station, the amount of needle deflection indicating the distance off-course.

Conforming to airline specifications in design and construction, the receiver tunes from 190 to 410 kc. at beacon position and from 550 to 1500 kc. at broadcast position, and has a range of 1000 miles during the day. The control panel is a metal case containing a tuning dial and operating crank, volume control button, power switch, frequency change-over switch and meter-shunt buttons, head phone connections and a Meter-O-Adjust control which is a spring button balancing the meter circuit after the desired station has been tuned in. Total weight of the receiver set and control panel is 18 lbs.

Personairlities

by Caldwell

● Every Christmas for the past eight years New England's flying Santa Claus, Captain William H. Wincapaw, has loaded up his ship with presents for the men who keep lonely watch in many lighthouses and Coast Guard stations along New England's coast, from Boston harbor to way down East in Maine. Last Christmas he took off at eight a. m. and flew for nine hours, covering more than a thousand miles and leaving a gift at each of 68 coastal stations. He was accompanied by his son William, Jr., youngest licensed pilot in Massachusetts, who occasionally relieved his dad at the controls, and by George Mason, Massachusetts governor of the NAA, which shouldn't be held against him. George dropped the presents out of a rear window of the plane—which is what I would like to do with most of the Christmas presents I have received during a long, sad life.

The first Christmas bomb was aimed by George at Spectacle Island, and the last one was dropped at Machias Seal Island light, in the Bay of Fundy. That island is half way between the Maine coast and the coast of Nova Scotia, and the lighthouse is operated by Canadians. That's how far the old Flying Santa got with his 400 reindeer Wasp-powered Travel Air. Each Christmas the folks wait for Wincapaw and gather in front of their building to watch the packages fall from the plane. Sometimes a bundle lands in the waves that pound the rocky shore, as one did this year at the whaleback station beyond Hampton Beach. But one of the station's crew set out in a dory and rescued the present. It must be great fun on a trip like that, trying to hit a Coast Guardsman on the head with a box of five-cent cigars—a splendid sport for retired rum-runners.

Captain Wincapaw, who now lives in Boston, the cultural hub of the universe (according to the Bostonians), was born in Friendship, Maine, in October, 1885. His father, perhaps sensing that in later years, during the summer season, potato bugs and tourists from Boston would trespass on their friendship, left Maine to Rudy Vallee and settled in Staten Island, a little island squeezed in between Brooklyn and New Jersey, where he soon had a large factory employing scores of workmen. Many of these men rode to their work on bicycles, for at that time people used to turn and stare at them automobiles, while street-corner wits would shout, "Git a horse!" and laugh uproariously.

Young Bill Wincapaw's first job was that of looking after and doing repairs on about a hundred bicycles. There must have been something about bicycles which just naturally drove men into aviation. The Wright Brothers, Glenn Curtiss and also the Farman brothers in France got their start in business with bicycles, you remember. Bill read about aviation and experimented with marine engines with his brother Sterling; they built a small one of their own design, but it blew up in their startled faces after a few revolutions, like one of the Washington administration's noble experiments when it gets to the Supreme Court. Then Bill experimented with wireless telegraphy until about 1911, when he learned that Glenn H. Curtiss was taking people for flights in a hydroaeroplane. So Bill galloped over to Hammondsport and paid Mr. Curtiss $25 for a flight, and decided then and there that aviation was his line. He had sailed boats along the coast of Maine and loved the water, so he took to seaplanes like a Roosevelt Democrat takes to boondoggling. It just came natural to him. Since his first lessons, which he took with Curtiss, W. H. has flown seaplanes and flying boats more than 9,000 hours and just for diversion, landplanes around 7,000 hours

Santa Claus Bill Wincapaw

Before the war Bill bought a Curtiss hydroaeroplane, as it was accurately but awkwardly designated in those days, and barnstormed along the Hudson River. He was awarded one of the early pilot ratings by the Aero Club of America, and has been flying now nearly a quarter of a century. When war was declared Bill sought to do his bit at the Front, but he was an old man of thirty-one then, far too old to do any fighting, the recruiting officer told him; so he had to be content with being an instructor on this side of the water.

After the war he returned to commercial aviation via the barnstorming end, which was about the only end there was at that time. He was a prime mover in the campaign to build an airport at Rockland, Maine. The field was built, Curtiss-Wright put in a base, and Bill Wincapaw was in charge of it. While he was with Curtiss-Wright, old Cap'n Bill won a warm place in the affections of the Down-easters. On many a dirty night he flew out to one of the islands off the coast on a hospital call to bring an appendicitis case back to the mainland, or perhaps an expectant mother. He has saved many a life in that way—more than twenty—so no wonder the folks in Maine have a warm spot in their hearts for him.

Bill joined Maine Air Transport and later, with Harold Moon, assisted in the operations of an airline between Wood's Hole and Nantucket. He now flies a Travel Air for La Touraine Coffee, and carries executives between the branch factories in Boston, Syracuse, Chicago, Philadelphia, and Jacksonville. During the summer months the Travel Air is on floats. So far, Bill has saved four lives with this ship. Flying from Southampton to North Beach one evening he saw four small boys adrift in a boat in Long Island Sound, heading for the sea. He landed and took the youngsters ashore. With the same ship, on wheels, he made a successful landing in a pasture near Burlington, Vt., after losing a wheel during the take-off. As he returned to land at the airport he saw ambulances and fire apparatus scattered all over the field, with mechanics holding up wheels to him. He flew calmly away from all that life-saving equipment, selected a pasture on a sloping hillside, and made a perfect landing, without injury to ship or passengers. He has carried more than 75,000 passengers during a busy flying career.

At fifty he is as active as a school-boy and can hold his own in any form of physical combat. He never drinks or smokes, and never has. As the song says, "the Gentleman evidently doesn't care for alcohol." Let that be a lesson to you boys who want to be spry at fifty.

* * *

● Just been looking over the 1935 edition of Jane's *All The World's Aircraft*, compiled by Leonard Bridgman, Edited by C. G Grey, and published by Sampson Low, London. In this, its twenty-fifth year of publication, Jane's continues to be the most useful general reference work in aviation. It contains all major developments of civil aviation in all countries during the previous year; detailed descriptions of the flying services of all nations; modern airplanes of all nations, illustrated by photographs and scale drawings, with complete specifications and performance data; aero engines of all nations, with photographs; airships of all nations; and much information about aerodromes, international records, and noteworthy flights. I recommend *All The World's Aircraft* to anyone needing a complete reference work. The price is $13.50 and the book may be secured through AERO DIGEST's Library Department.

Mr. Grey unfortunately failed to include in the work a description of one of the latest English transport aeroplanes, the Sidestrand-Cannibal-Chuffington, illustrated herewith. It was designed by Douglas Rolfe and built, bit by bit, by the good old English firm of Sir Chuffington-Chuffington Caldwell, Ltd. (pronounced Chumley) at their works at Slough-under-Slyme, Herts, Nerts. Sir Chuffiington-Chuffington Caldwell, I might add, is a very distant relative of mine who never has expressed any yearning to decrease the distance between us.

The Sidestrand-Cannibal-Chuffington is still on the Air Ministry's Secret List, for it may be used as a bomber by the Air Force in a national emergency; so I am unable to give performance data. But the bally thing is terrifically fawst, I can assure you. I am told by spies that the good old Chuffington would leave a Douglas standing, if it happened to be going and the Douglas happened to be standing at the time. Anyhow, it's much fawster than a train, especially a goods train; and not one of the Channel steamers can keep up with it. Just the other day, I hear, the Chuffington flew pawst a Channel steamer, and in ten minutes was almost out of sight. Fawncy that now!

I don't know how Mr. Grey, who is also editor of *The Aeroplane*, a British and Best Comic Weekly, happened to overlook the Chuffington, unless perhaps it oozed out while he was in Germany getting material for a series of laudatory articles about the former enemy, whom he now regards as a long-lost brother to whom all is forgiven. Judging from the air of worship for all things German which Mr. Grey now injects into his *Aeroplane* writings, I conclude that he went through Hunland on his hands and knees, wagging his tail ingratiatingly.

* * *

● Major Burdette S. Wright, Air Corps Reserve, was born Sept. 12, 1893, at New Albany, Ind., and educated there and at Louisville, Kentucky, where he graduated from High School, and then in due time entered Purdue University at Lafayette, Ind., emerging in 1915 with the degree of B.S., an especially useful degree for one who is eventually to become a Sales Manager.

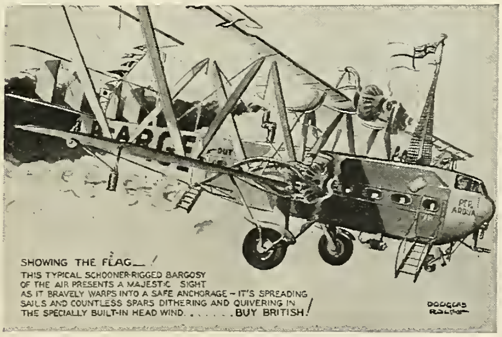
For two years following his graduation, Birdie Wright picked out a light line of jobs in the fields of electricity, as Assistant Electrical Engineer of the Iowa Railway and Light Co., and associated properties, with headquarters in Cedar Rapids, Ia. By April 1917, the efforts of the English to fool Colonel House, Ambassador Walter Hines Page, and President Woodrow Wilson, ably seconded by the natural stupidity of those who controlled the German submarine policy, had at last been crowned with success, and an embattled America leaped to arms—much to the financial betterment of poor J. P. Morgan & Co., who were to make a measley thirty million bucks in commissions as purchasing agents for the Allies. Stirred by patriotic fervor or something, thousands of practical patriots began to scrap for their country by producing wheat, cotton, shells, guns, airplanes, automobiles, ships, and other supplies (at a profit). Other patriots, with rather less sound reasoning, enlisted in the military forces. Leading the latter was young Mr. Wright, who switched from the Iowa Railway and Light Co., and flashed into the fray via Fort Snelling, Minn., and Fort Monroe, Va.

In those hot beds of military culture, Wright soon found out which end of the gun the bullet came out of. In short, he learned to his surprise just how far we highly civilized people had progressed during the twenty centuries that we and our ancestors have been pretending to be full of brotherly love for our neighbors. It was all very illuminating to him, and in November, 1917, he developed into a bright and shining 1st Lieutenant in the Coast Artillery Reserve Corps, prepared to blow up anyone who even suggested that we were not a peace-loving people fighting in the war to end all wars, and bag a nice fat bonus for doing it.

Lieut. Wright was ordered overseas and attended the Coast Artillery School at Mailly Camp 2, from January to March, 1918, when, as the result of an early request, he was given a crack at Aerial Observation, attending the Observation School at Tours, France, and the Aerial Gunnery School at Cezaux. He reported to Escadrille S.P.A. 54 French front on the 10th of June, 1918, and shot dice with them there and later with the 12th Aero Squadron, American, until Nov. 4, 1918, when he was palmed off on the 5th Army Corps Observation Group as Operations Officer. In the meantime he had been transferred to the Air Service, commissioned as Captain, and then shipped back C.O.D. to the U. S. on March 13, 1919.

In the spring and summer of 1919 Captain Wright received pilot training at Bolling Field, Washington, and was then rated both airplane pilot and airplane observer. Incidentally, it is becoming evident that Army Air Corps officers must be in need of special training in the art of landing at Bolling Field—perhaps from some old commercial pilot who really knows how to fly in bumpy weather. Two Army airplanes recently crashed while trying to land over that hill back of the field. I would like to hint, in the most diplomatic and polite manner possible, that when trying to land at Bolling Field and still be alive after the landing, it is advisable to bring the plane down with sufficient speed to assure control and thus be able to counteract the effects of vicious bumps which infest that hill in certain winds. After clearing the hill, if the speed is excessive it may be dampened down by fish-tailing, or by overshooting the field and landing in the Anacostia River, from which the Navy lads living nearby will be very happy to retrieve any ducked Army aviators. The Army has become so discouraged trying to teach their pilots to land at Bolling intact that they finally have decided to give the field to the Navy, and are moving a mile down the river, where the air is smoother. The Navy don't expect to have any trouble at Bolling.

B. S. (Birdie) Wright


SHOWING THE FLAG—!
THIS TYPICAL SCHOONER-RIGGED BARGOSY OF THE AIR PRESENTS A MAJESTIC SIGHT AS IT BRAVELY WARPS INTO A SAFE ANCHORAGE – IT'S SPREADING SAILS AND COUNTLESS SPARS DITHERING AND QUIVERING IN THE SPECIALLY BUILT-IN HEAD WIND. . . . . . .BUY BRITISH!
DOUGLAS ROLFE
AIR BARGE
OUT
PER ARDUA
The Sidestrand-Cannibal-Chuffington biplane

In 1919 while he was on duty in the Office of the Chief of Air Corps, Captain Wright was made aide to the then Assistant Chief, Brigadier-General William Mitchell who in 1925 fearlessly started a war of his own with the General Staff, and discovered that he was the first casualty. I understand that one thing which led to the appointment of General Westover as Chief of the Air Corps is that he doesn't bear the slightest resemblance to Billy Mitchell whose United Air Force policy still stalks onto the aviation scene like the ghost of Hamlet's father, to haunt his enemies. General Drum, I hear, sometimes wakes up at dead of night to find the doctrines of Billy Mitchell perched on the end of his bed, making faces and weird noises, and declaring that if the Army can't do better with its aviation that the Navy will be forced to take it over and run it in the next war.

Captain Burdette Wright was given the assignment of organizing an airway section and airway operations for the Army Air Corps back in 1919, and introduced various facilities including weather maps, radio stations, airway markings, and other developments to increase the efficiency and safety of cross country travel by air. This was the first concerted move to wean pilots away from the habit of following railroad tracks, which before that time were the principal means by which any of us found our way about the country. Which reminds me that Dick Depew was completely baffled by it one day when the "iron compass" he was following went into a tunnel. He flew over the hill and found two

(*Continued on page* 68)

THE AIR SERVICES

114 Planes Ordered

Secretary of the Navy Swanson awarded a contract totalling $3,636,000 for the purchase of 114 airplanes and spares from the Douglas Aircraft Co. The planes are torpedo-bombers of the TBD type for carrier service.

The TBD torpedo-bomber is a new type of low wing monoplane powered by a P. & W. Twin Wasp. It will have greater speed, range, as well as other improved characteristics of performance over previous types of this class used on carriers.

To keep pace with increases in other branches of the Navy toward the Washington Treaty strength objective by 1942, a program for a total of 1,910 combat planes by that time is now being followed. At present the Navy has 1,068 planes actually in service and 400 others contracted for. Average necessary annual replacements amount to about 300 planes.

In President Roosevelt's recent budget message to Congress, $27,600,000 was set aside in proposed new naval appropriations, plus unexpended funds on hand, for the purchase of new planes.

Since completion of the new planes will coincide approximately with the dates on which the aircraft carriers *Yorktown* and *Enterprise* are due to be finished, most, if not all of them, undoubtedly will be assigned to these ships.

Cheney Award

For performing an act of valor and self-sacrifice worthy of the highest commendation, the Board of Air Corps officers, appointed to select the recipient of the Cheney Award for the year 1935, designated 1st Lieut. Robert K. Giovannoli, Air Corps, recognizing his bravery in the rescue of two men from the Boeing 299 at Dayton, Ohio, on Oct. 30, 1935 as the most outstanding and meritorious act performed by any individual eligible to receive this award.

Mid-Winter Tests

From Feb. 1-15, Major-General Frank M. Andrews, Commander of the GHQ Air Force, conducted a service test of various items of aircraft equipment under conditions of severe cold weather. While this test was under way there also was an opportunity to observe the efficiency of men working under trying conditions.

The maneuver had three phases. During the first, bombardment aviation based at Concord, N. H., simulated attack of the aviation facilities at Mitchel Field, N. Y. Mitchel Field was defended by pursuit and attack aviation based there. In the second phase, Mitchel Field, defended by pursuit aviation, was attacked by both bombardment and attack aviation based at Concord, N. H. In the third phase, the scene shifted from Mitchel Field to Burlington, Vt. Burlington, defended by pursuit aviation based there, was attacked by bombardment and attack aviation based at Concord.

Tactics of the maneuvers were secondary to testing of equipment.

Cook to Head Bureau

Changes in the Navy high command, to become effective in June, provide that the present Chief of the Bureau of Aeronautics, Rear Admiral Ernest J. King, become Commander Aircraft, Base Force, and that Capt. Arthur B. Cook, now commanding the aircraft carrier *U.S.S. Lexington,* succeed him as head of the Bureau.

Other changes elevate Vice Admiral Arthur J. Hepburn to the post of Commander-in-Chief of the U. S. Fleet with the rank of Admiral, and Rear Admiral Frederick J. Horne as Commander Aircraft, Battle Force, with the rank of Vice-Admiral.

The Bureau of Aeronautics has been headed by Admiral King since the death of Admiral William Moffett in 1933.

Hangar Construction

First steps in construction of an $85,000 army air base hangar at the Oklahoma City municipal airport followed less than 48 hours recent orders issued for the transfer of the Army base from Hatbox Field at Muskogee, Okla., to Oklahoma City.

Maj. Gen. Johnson Hagood, Eighth Corps Area commanding officer, instructed Capt. Ed. Sullivan, Hatbox Field commander, to move his staff of five enlisted men, four airplanes, and other equipment to Oklahoma City immediately, where temporary facilities were made available.

Plans for the hangar, which will include offices and machine shop, have been ready for some time.

Engine heating tent and ski equipment used in winter maneuvers by Curtiss A-12 attack planes

Suggests More Airships

A continuing program of construction and use of lighter-than-air craft has been unanimously recommended to Secretary of the Navy Swanson by the Naval Science Advisory Board in its report. The Board consisted of eight members, including Prof. William P. Durand of Stanford University, who acted as chairman.

The Board expressed the opinion that the design, construction, and operation of service airships were practical. It recommended that the Navy Department continue to build non-rigid and rigid ships of small or moderate size as service requirements indicate, and extend to ships of large size the opportunity of furnishing grounds for definite conclusions regarding the useful naval service of these constructions.

Army Approval

Following experiments conducted for more than a year, the U. S. Army Air Corps has adopted DuPrene, a synthetic rubber manufactured by the duPont company, as standard for lining gas and fuel line connections and for radiator connections on airplanes, the latter where engines are water-cooled. Recently issued specifications by the Air Corps require the use of DuPrene instead of natural rubber for these connections.

These connections are used to prevent the vibration of the engine from breaking the fuel and oil lines through crystallization of the metal tubing. In the experiments preceding its adoption, DuPrene was found to resist deterioration by oil and grease and to be unaffected by anti-freeze solutions in water-cooled engines. Line connections of DuPrene, such as the Army has just adopted, have been used by the Navy Bureau of Aeronautics for about a year.

Changes

Capt. Rudolph Fink, on duty with the First Pursuit Group at Selfridge Field, Mt. Clemens, Mich., has been appointed Air Corps representative at the Boeing Aircraft factory, Seattle, for a period of about two months to flight test 23 P-26C airplanes being procured from that company. He recently departed for Wright Field, Dayton, Ohio, for temporary duty for the purpose of receiving instructions as to the method of testing the airplanes at the Boeing plant, and will then proceed to Seattle. Upon the completion of this temporary duty, he will ferry the last airplane to be delivered on this contract to Selfridge Field.

AT THE AIRPORTS

Traffic

More than 60,000 airline passengers flew into or out of Union Air Terminal, Los Angeles, in 1935, according to the annual report of President P. W. Wright. The exact total was 60,793.

Transport landings and take-offs for the year totalled 10,618, as against 7,641 in 1934. Total landings and take-offs for all aircraft utilizing the port were 48,611. Advances were also scored in the general flying of more than 100 private and commercially owned aircraft basing at the field. These activities included 3,146 flights by private owners; 9,138 student instruction flights; 1,745 miscellaneous commercial flights; 1,208 passengers carried on charter-plane flights; 3,591 passengers on local sight-seeing hops, and 3,343 visiting planes, in addition to the 605 Army or Navy craft that called during the year.

* * *

Approximately twice the number of passengers used the Buffalo Municipal Airport in 1935 than did in 1934. Passenger traffic totaled 56,340 in 1935, compared with 29,473 in 1934 with the high month last year, October, seeing 7073 passengers arrive and depart. August, highest month in 1934, had 3968 passengers. Plane arrivals in 1935 were 5710 and departures, 5721, compared with 4585 and 4622 respectively in 1934.

Repair Stations

Dallas now has one of the most complete and modern aircraft repair depots in the country, a $100,000 institution at Love Field which is owned by Booth-Henning, Inc. This is the only station of its kind in the Southwest, aside from those operated by commercial airlines, which has facilities for testing and repairing instruments.

The concern is located in the center of the hangar row at Love Field in a new $75,000 hangar which is the most modern there, and large enough to house the largest plane. Equipment for engine repairs, aircraft and instrument facilities cost $25,000.

The company is directed by Ed F. Booth and Hal P. Henning, and is also distributor for Stinson aircraft and Lycoming engines.

* * *

Ames Aircraft Corp., of the Boston Municipal Airport, E. Boston, Mass., which formerly was associated with Skyways, Inc., has reverted back to its original charter and is now under the management of Harry Ashworth. The company is conducting a repair business on instruments, propellers, magnetos, carburetors, starters, etc. Oliver Ames is president, and S. G. Wilbas is acting treasurer.

WPA Appropriations

Improvements involving an expenditure of $490,000 were launched at the Seattle municipal airport by Fred G. Guenther, WPA district director. These include draining and grading, surfacing the landing area, grading and seeding a portion of the area, fencing the field, and the installation of obstruction, boundary, flood and runway lights.

* * *

Final approval and release of $175,000 in WPA funds for development of the Muscle Shoals, Ala., airport has been given, and a 240-acre tract secured. The Tennessee Valley Authority is interested in seeing the project through to completion as Muscle Shoals is one of the important links in the Tennessee Valley. The field will be equipped for night flying with power supplied by the TVA.

Maj. William Centner, superintendent of Port Columbus, Columbus, Ohio, has announced a $1,000,000 WPA improvement at the port. Plans have been approved by Service Director Llewellyn Lewis of Columbus, and will be submitted to the Bureau of Air Commerce. Included in the work are construction of a new E-W runway in connection with blind landing facilities, construction of a 3500-ft. N-S runway, revision of the administration buildings to provide enlarged and improved space for handling of mail, and possibly hotel accommodations for air travelers, construction of a railroad siding, installation of a radio airport control system, painting, redecorating, grading and surfacing.

* * *

Plans for a $50,000 county airport improvement program were announced Feb. 1 by Supervisor Raymond C. Bice, chairman of the LaCrosse (Wisc.) county board's airport committee. The program, according to plans of the committee, will be carried to completion under the WPA. A 100 by 100 ft. hangar is included in the project.

* * *

Formal approval of Oklahoma City's airport improvement project in Washington has been received and work on the project, which includes construction of a new hangar, started. Funds approved for the job total $66,879 and the city will add $10,000 with additional money transferred from other city WPA projects to defray the total cost of the program, which will be approximately $85,000.

* * *

WPA has approved the $1,205,160 Buffalo (N. Y.) airport project which calls for extension and widening of runways, which already have been undertaken, and for construction of a new administration building and modern hangar to replace three existing ones. The removal of a ridge, which will improve landing facilities, is also contemplated.

* * *

The city of Tupelo, Miss., is building a $45,000 airport as one of its WPA projects. Plans for the new airport call for preparatory ground work and construction of runways, a hangar and other buildings and also installing flood lights and a beacon.

Expansion

The H. C. Robbins Co., of Cleveland, Ohio, has started an expansion program in which the first step was the acceptance of the distributorship for Rearwin Airplanes, Inc., throughout the state. The company has also been selling Wacos.

In addition to taking over this distribution and creating a new sales department under Stewart V. Kramer, the company plans to establish two new offices and hangars in Ohio this year. The taxi and complete hangar service, distribution of Continental and Jacobs engines, and other services now offered by the company will also be undertaken by the new offices.

New Company

The National Aviation Supply Co., aircraft equipment brokers, have opened offices at the Boston municipal airport in the Shobe Airlines hangar. The company, organized as aircraft and equipment brokers, will serve airlines, private owners, and operators of aircraft. Plans are now under way to handle the distributorship of a light sport plane. Parts and equipment will be stocked during the coming six months. Officers are Irving Johnson, president, and Frank P. Gallant, vice-president.

New Booth-Henning hangar at Love Field. Officers of the company are E. F. Booth, Wayne Petit and Hal P. Henning

AIRLINES AND AIR TRAVEL

1935 Traffic

Airline operators in the United States carried 746,946 passengers in 1935, the largest total for any year in their history and an increase of 61 percent over 1934. The highest yearly passenger figure previously was 493,141 in 1933; the total was 461,743 in 1934. These statistics are for lines within the borders of the United States only; those for operations during 1935 on extensions to Canada and Latin America are not yet available.

These lines flew 55,380,353 miles during 1935 and carried 3,822,397 pounds of express. Passenger miles flown were 313,905,508 and each represents a new record.

* * *

United Air Lines in 1935 registered an increase of 21 percent in revenue passengers, carrying 177,433 as against 147,139 in 1934. Planes flew 15,000,000 miles over approximately 5000 route miles, carrying 900 tons of air express and 3300 tons of air mail. Last year United flew 30 percent of all passenger miles, 44 percent of all air mail and 50 percent of all air express in the United States.

* * *

An increase of 185 percent in passenger traffic over Pennsylvania Airlines was reported by C. Bedell Monro, president, who said his company transported 14,128 passengers in 1934, and 40,237 in 1935. Last month Pennsylvania discarded the last of their fabric ships and put into service along the Washington-Detroit route twin-engined all-metal Boeing planes.

* * *

American Airlines completed the best year in its history with a record of 178,209 revenue passengers carried during 1935, C. R. Smith, president of the company announced. This figure represents an increase of 71.77 percent over the 103,745 passengers transported in 1934. It represents a monthly average of 14,850 passengers to compare with the 8,645 averaged during each of the twelve preceding months. Without exception every month of the past year represented a gain over the comparable month of 1934, these gains ranging from 9.4 percent to 179.9 percent. The total for December was 12,710 passengers, an increase of 55.6 percent over the 8,157 passengers transported in December, 1934.

American Redistricts Offices

Oklahoma City has been made a district office for American Airlines, Inc. replacing Ft. Worth as the southwest area headquarters following redistricting of the company's national network.

Schedule Revisions

Additional service which doubles the facilities for passengers, mail and express on week days between Boston, Portland, Augusta, Waterville and Bangor, were established by Boston-Maine Airways January 2. The new service provides two round-trips except on Sundays and holidays, with morning and afternoon departures from Boston to Bangor and similar service from Bangor to Boston, serving intermediate points in both directions. The old schedule of one round-trip will continue on Sundays and holidays during the winter months.

* * *

On the line of Boston-Maine-Central Vermont Airways, between Boston; Manchester and Concord, N. H.; White River Jct., Barre-Montpelier, and Burlington, Vt., the scheduled running time of the southbound trip has been changed to operate later and provide closer connections with planes to New York City and other points. The northbound trip now operates five minutes earlier than formerly.

* * *

Substantially shorter and faster service to Miami, Fla., for travelers on the TWA system proceeding from Los Angeles and intermediate western cities, has been made available through a rearrangement of the eastbound *Sky Queen* coast-to-coast schedule. The flight in its new departure and arrival times, leaves the Pacific Coast and arrives at intermediate stations and its destination, New York, nearly thirty minutes ahead of former scheduled times.

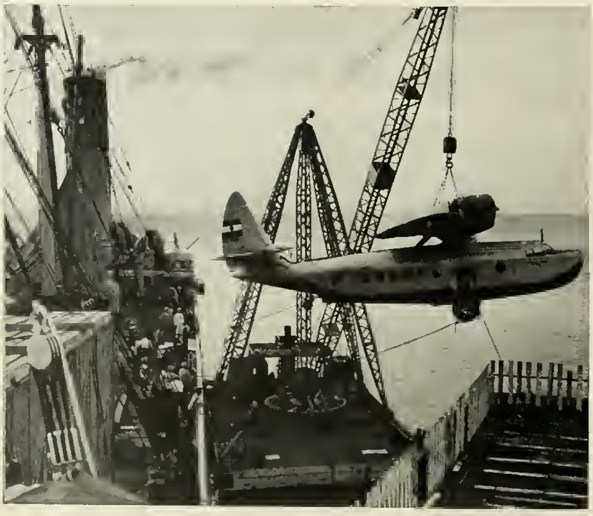
The change in the schedule has been made to permit better connections for Florida and plane and train connections along the TWA system. Through an earlier arrival at Indianapolis, passengers aboard the *Sky Queen* connect with a plane of Eastern Air Lines which lands them in Miami at 10:25 a. m. Departure from the Pacific Coast city will be at 9 a. m., rather than 9:30 a. m.

Flight Twelve, which connects with the *Sky Queen* at Kansas City for the flight to Chicago, now leaves at 8:45 p. m., rather than 9:12 p. m., arriving at Chicago at 11:05 p. m. This arrival time, twenty-five minutes earlier than before, permits better plane and train connections at that point.

E. A. L. Advertising

Eastern Air Lines has appointed Benton & Bowles, Inc., of New York, to handle its advertising. James S. Adams, vice-president and general manager of the agency, is serving as account representative. Although future plans are undecided, it is understood that newspapers will be the primary media used this year.

Sikorsky S-43 amphibian for Inter-Island Airways being delivered at Honolulu



More Douglases Ordered

American Airlines, Inc., has placed an additional order for ten more new Douglas DST transport planes. This second commitment brings the total number of the new-type Douglas transports on order by American Airlines to 20, representing an investment of approximately $2,500,000.

The transports in the second order will be equipped as day planes with accommodations for 24 passengers. Of the planes in the first order, eight will be convertible sleepers with accommodations for 16 passengers.

The first of the new planes, one of the sleeper plane series, was delivered to American Airlines at the conclusion of the Los Angeles Aircraft Show and the 19 others will follow at a rate of approximately one a week. The company plans to have the entire fleet in operation before the middle of the summer.

New Services

American Airlines inaugurated a daily shuttle service between Washington and Nashville, Tenn. Stops are being made at Knoxville, Bristol, Roanoke and Lynchburg, Va.

* * *

New passenger and express service was established between Chicago, Ill.; Fort Wayne, Ind.; Dayton and Columbus, O., by Columbia Airlines, Inc., with Vultee V1-A transports.

Personnel Changes

M. F. Redfern, formerly district traffic manager of United Air Lines at Philadelphia, has been made district traffic manager at New York for the same company, succeeding B. B. Gragg, sales manager of the company, who has returned to Chicago to resume his direction of the sales activities of the company's Traffic Department.

* * *

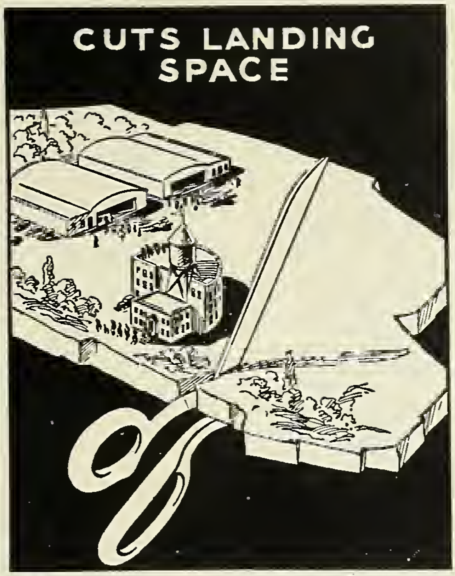
The appointment of D. Walter Swan as vice-president in charge of traffic of Central Airlines was announced by J. D. Condon, president. Before joining Central, Swan was with TWA in Chicago.

* * *

Robert S. Fogg has been appointed Boston district manager of Marine Airlines which plans to inaugurate N. Y.-Boston seaplane service with Sikorsky S-43s. George Mason has been named publicity director of the system.

* * *

Roy E. Roose, former general sales manager at Chicago for General Air Express, has been appointed city passenger agent for Northwest Airlines at Seattle.



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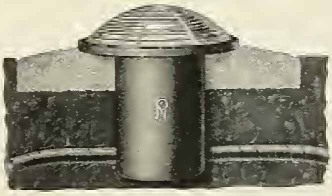
The instrument approach system at Indianapolis is similarly equipped.

Write for Bulletin 210-B-1 for data on the complete Pyle-National line of airport and aircraft lighting equipment.



The **PYLE-NATIONAL**
COMPANY, 1334-58 N. Kostner Ave., Chicago

ACTIVITIES AT THE SCHOOLS

Enrollments

Parks Air College student enrollment for the Winter term totals 31, maintaining the record enrollment of 253 established at the beginning of the last fall term. Enrollment by schools shows executive transport pilot's school, 40; engineering school, 82, and master mechanic's flight school, 97. Special work is taken by 34 students.

* * *

Twenty-two new students recently enrolled at Roosevelt Aviation School, consisting of three combination limited commercial and regular mechanics courses, five regular mechanics courses and fourteen master mechanics courses.

* * *

Boeing School of Aeronautics at Oakland municipal airport is now housing the largest enrollment in its history, with 190 students taking ground and flying courses. Of the total, 57 are taking the flying courses.

* * *

Five students recently arrived for flight and ground school instruction at the Ryan School of Aeronautics in San Diego.

* * *

Thirteen students enrolled at the Rising Sun Aircraft School, Inc., Philadelphia, at the beginning of January classes, for the Master Mechanics' Course. Eight graduates received the Department of Commerce Airplane and Engine Mechanics' Licenses during recent months.

New Courses

Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, is giving a new night course featuring instruction in aircraft sheet metal fabrication. Students will complete their training at the end of a 20-week period, during which time they attend school three hours a night, five nights a week.

According to C. C. Moseley, president of the Institute, the course has been offered due to the demand of prospective students as well as the demand of several local aircraft factories for trained metal workers. H. E. Horn has been added to the Institute's staff to handle the new class.

An increase in the demand for night flying instruction at the Grand Central Flying School is responsible for the school devoting two nights a week for this type of instruction, according to Joe Plosser, president.

* * *

A free course in Aeronautics is being organized in San Francisco's Galileo Evening High School and in the Humboldt Evening High School, Technical Dept. This course, in which Junior College Credit may be obtained, will cover a complete ground school range.

* * *

Lake Erie College, a girl's college at Painesville, O., is offering a flight and aeronautical ground course. Ground school work, given in the college, includes fundamentals of flight, meteorology and other subjects, followed by lectures by pilots. Actual flight instruction is provided by Philip A. Meinke, operator of a near-by flying service.

Personnel Changes

Capt. E. Stanley Beck, of the 26th Division, Massachusetts National Guard, stationed at the Boston Municipal Airport, East Boston, Mass., has joined the New England Aircraft School, Inc., Boston, in an executive position.

Lieut. J. W. Geppert, USNR, has been appointed chief instructor of the ground school at Robertson Aviation School, Robertson, Mo. Lieut. Geppert received his training at Miami and Pensacola during the War, served as instructor at M.I.T., and at Miami in naval aviation.

* * *

Walter K. Balch, formerly attached to the San Diego Naval Air Station, has been placed in charge of aircraft engine instruction at the Ryan School of Aeronautics and will have supervision of engine lectures as well as engine overhaul.

* * *

Parachute instruction at the Boeing School of Aeronautics is now under the direction of Wesley Davis. Instruction in parachutes is included in the Instrument Laboratory course, and covers the care, use, and packing of parachutes.

* * *

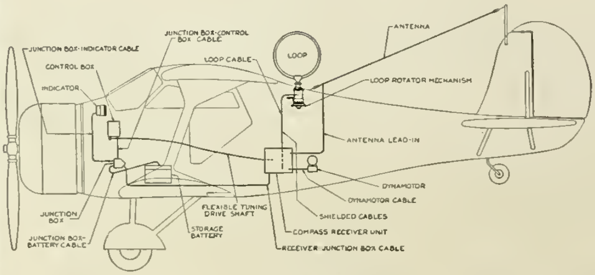
Another flight instructor has been added to the staff of the Grand Central Flying School, Glendale, Calif. He is William Warren, formerly test pilot for Kinner Airplane & Motor Corp., Ltd. Lee Williams, recently returned from Mexico, is taking Thomas Winfield's place as instructor there until the latter recuperates from an illness.

South American Tour

O. J. Whitney of the O. J. Whitney Flying Service, North Beach, N. Y., and Burnham Litchfield, of the Fairchild Aerial Camera Corp., have reached Santiago, Chile, as this was being written, on their aerial demonstration tour of Central and South American countries. They are demonstrating a Jacobs-powered Beechcraft fitted with a Kruesi Radio Compass, Fairchild Aerial cameras and carrying samples of Merrimac aircraft finishes.

Leaving New York City on January 4 they made demonstrations at Miami, Havana, San Salvador, San Jose, Cristobal, Bogota, Quito, Guayaquil, Lima and Santiago. They expected to be in Buenos Aires by February 22 and in Rio de Janeiro before March 1. A telephone report from Santiago stated the American aviation equipment evoked tremendous interest at each stop. The Kruesi Radio Compass, they reported, was of special assistance in navigating over water and mountains.

Whitney, Litchfield and the Jacobs-powered Beechcraft in which they are touring South America



INSTALLATION OF KRUESI RADIO COMPASS SHOWING VARIOUS WIRES AND CABLES REQUIRED

PRIVATE FLYING AND CLUB NEWS

1936 Officers

At the annual meeting of the Soaring Society of America, held in New York City at the Hotel New Yorker, Lieut. Comdr. Ralph S. Barnaby, USN, was reelected president. Other officers chosen include Earl R. Southee and Dr. Karl O. Lange, vice-presidents; Richard C. duPont, treasurer; and Donald Hamilton, secretary. It was decided to hold the Seventh Annual National Soaring Contest at Elmira, N. Y., from June 20 to July 5.

Members of the Oklahoma City Aviation Club elected Moss Patterson president for the coming year to succeed Orval Mosier. Other officers named were Jerome Sass and Herbert Howell, vice-presidents; Una Goodwin, secretary; and Clyde Nickols, treasurer. The club discussed plans for holding another of its statewide air tours early this spring and outlined other plans for 1936.

* * *

Officers of the Aero Club of Buffalo, (N. Y.), recently elected for 1936 include E. Howard H. Roth, president; Burdette S. Wright, vice-president; Duncan A. MacLeod, treasurer; Roy L. Scott, secretary; and J. A. Williams, assistant secretary. In addition 21 directors were chosen and four committees appointed. These include the entertainment committee under the chairmanship of J. A. Williams; membership committee, Conrad Machemer, chairman; ways and means committee, Lawrence Tremaine, chairman, and the awards committee, F. Leslie Marsden, chairman.

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PERFORMANCE
115 m.p.h. Top; 105 m.p.h. Cruising

SAFETY
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THE INDUSTRY IN GENERAL

Production

Reports based on 98 percent of the aircraft manufacturing facilities in the United States show that in the year ended Sept. 30, 759 commercial and private airplanes were built, compared with 234 built for military use, E. E. Wilson, vice-president of the Manufacturers Aircraft Association, Inc., said at the annual meeting. There was a slight increase in the building of commercial airplanes in the period.

B. D. DeWeese, president of Stinson Aircraft Corp., was elected a director to succeed W. A. Mara. William E. Valk, Jr., of the Wright Aeronautical Corp., a director of the association, was elected vice-president. John A. Sanborn was elected secretary to succeed John M. Rogers, who remains a director.

* * *

Commercial airplane production in November, 1935, with 91 units, showed an 80 percent increase in number, and a 19 percent decrease in value as compared with November, 1934. As compared with November, 1933, there was an increase of about 150 percent in number of units, and 396 percent in value.

Transport planes produced during the month totaled 11 units out of the total of all types. Their value, however, accounted for 73 percent of the total commercial airplane production value.

Commercial engine production at 134 units was down 22 percent in number and 59 percent in value as compared with November, 1934. In comparison with November, 1933, units were up about 75 percent, and value was up 42.3 percent. This is reflected in a decrease in the average unit value.

Total commercial production value was down 37.7 percent from November, 1934, and up 181.8 percent from November, 1933.

Military airplane production was down about 25 percent in number of units with 36, and 5.6 percent in value from November, 1934. Comparison with November, 1933, shows increases of 89 percent in units and 273.8 percent in value.

Deliveries showed about the same general relationships as did production, with the exception of commercial airplanes and engines in November, 1934. The fact that the number of commercial planes produced is almost identical with the number delivered, and that production value is over twice delivery values, is reconciled by a partial analysis of the totals, which shows production of 16 multi-engined planes valued at more than $1,000,000 as compared with the delivery of 5, valued at $298,000.

Nebraska Legislation

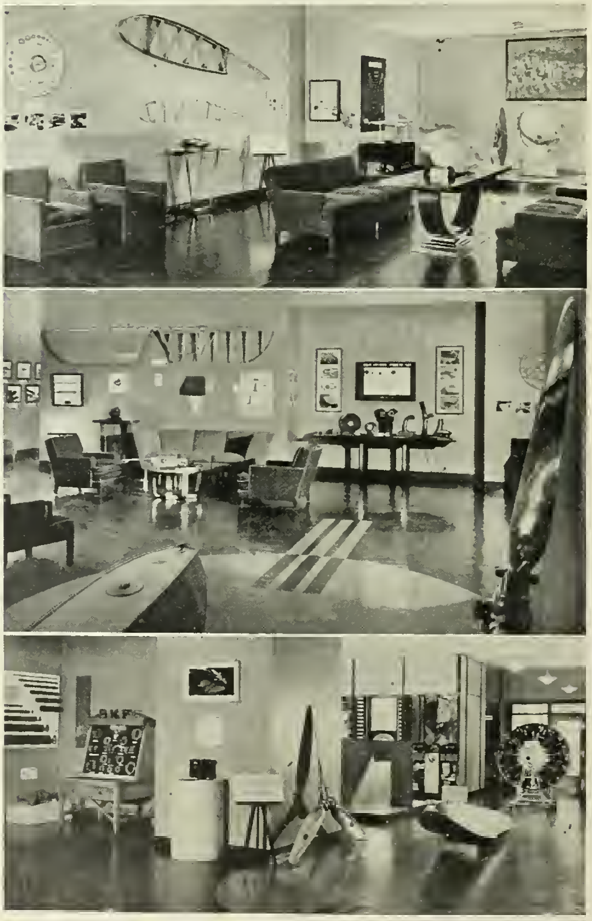
A broad plan for regulating aviation within Nebraska has been formulated by the State Aeronautics Commission, organized under a statute passed in 1935. The plan has the dual purpose of making flying safe through strict regulation and of making air travel popular through promotional activities.

Jurisdiction of the commission extends to aircraft, pilots, aviation schools, airports, airport managers and mechanics. A set of rules and regulations, corresponding largely to federal regulations, has been worked out by Secretary Charles Doyle and was adopted by the commission last month.

In its statement of policy the commission proposes to acquaint the public with efforts toward safe air transportation and gain public confidence in such transportation. As promotional efforts toward this end it proposes to provide navigational aids, airmark towns and encourage construction of airports and landing fields to give a wider range of safe air travel and to open territories less conveniently reached by ground transportation.

As the first step in development of airports, the commission is encouraging key towns along the routes of natural travel to secure such sites, with present government projects being given immediate attention.

"Metals in Aviation" Exhibit in Rockefeller Center, sponsored by Aero Digest



Officials Meet

The first regional meeting of 1936 of the North Central District of the National Association of State Aviation Officials was held recently at the Plains Hotel in Cheyenne, with 176 delegates from 21 states in attendance.

One of the most important topics discussed during the two-day session was the matter of proper legislation and revision of existing air mail laws. An appeal was made to delegates that they contact their respective state congressional delegates in Washington enlisting their aid to secure a fairer remuneration for the operators for carrying the mail. Dr. Raymond Staub of Portland, Ore., supported this topic and requested the Association to petition the Government to loosen the straps which have been tightened by the Post Office Department in the matter of air mail.

A noon luncheon was sponsored by the Cheyenne Junior Chamber of Commerce, at which time Tilton Keefe, chairman of the organization introduced Governor Miller, of Wyoming, who in turn introduced Colonel Roscoe Turner, who was the principal speaker.

Among other subjects discussed was the adoption of the Uniform State Aeronautical Regulatory Act and the air marking and mapping program.

Flight Violations

Nearly 50 percent of the fatalities in miscellaneous flying operations during the first half of 1935 occurred in flights which violated the Air Commerce Regulations, the Bureau of Air Commerce, Department of Commerce announced.

Of 124 fatalities in miscellaneous, commercial and private operations during that period, 56 resulted from accidents in flights which were contrary to regulations. Illegal acrobatics contributed to the death or fatal injury in airplane accidents of 15 pilots, 3 student pilots and 4 passengers.

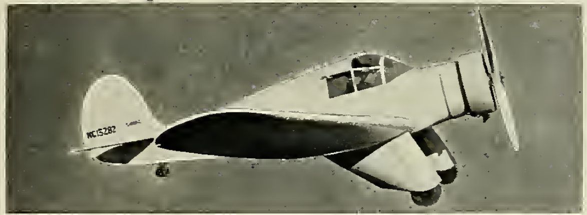
The 56 fatalities occurred in 37 fatal accidents, each of which violated one or more provisions of the regulations.

Eleven fatal accidents were listed under the infringement of miscellaneous regulations and involved a total of 16 different violations, including students carrying passengers, 4; overloading, 1; instructing an unlicensed student, 1; incompetency and performance of acts contrary to public safety, 8; flying for hire in aircraft with expired license, 1; flying for hire outside of area authorized by license, 1.

(*Continued on following page*)

*ORDERS are Rolling In!

Aeronca Low Wing



ORDERS—with deposits—confirm Aeronca's belief that the *Low Wing* Aeronca is the answer to private owners' and school operators' greatest need!

For six years, the Aeronca C-3 has been recognized as the world's outstanding light training plane. The *Low Wing* Aeronca, for advanced training, chartered trips, and private use, is a fitting companion to the well-known C-3. Thus Aeronca offers an unbeatable combination—and again proves its leadership.

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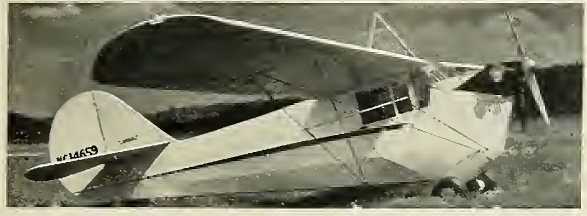
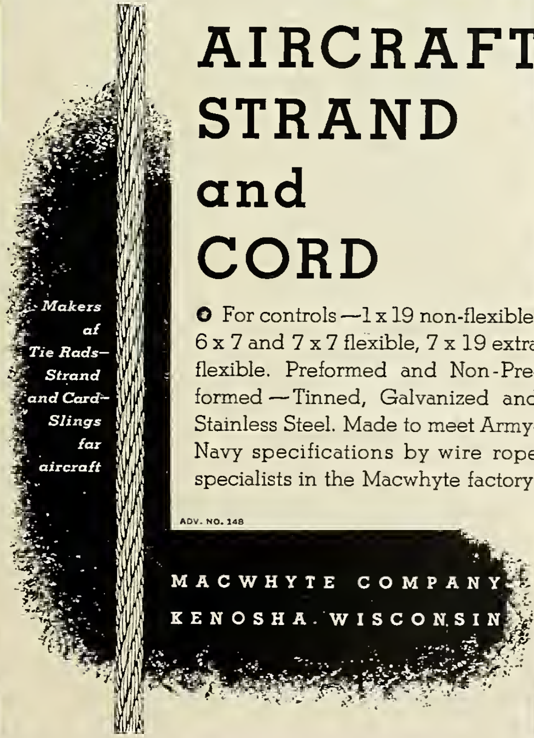
Aeronca C-3



MACWHYTE AIRCRAFT STRAND and CORD



Makers of Tie Rods—Strand and Cord—Slings for aircraft

○ For controls—1 x 19 non-flexible, 6 x 7 and 7 x 7 flexible, 7 x 19 extra flexible. Preformed and Non-Preformed—Tinned, Galvanized and Stainless Steel. Made to meet Army-Navy specifications by wire rope specialists in the Macwhyte factory.

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SUNCOOK MILLS
34 Thomas Street, New York, N. Y.

(*Continued from preceding page*)

Business Reports

Val Dietz, Jr., sales manager for Suncook Mills, reports sales for January and February considerably higher than for the corresponding months in 1935. In addition to an increase in commercial business, two Navy contracts for Grade A Flightex were received. The fabric supplied on these contracts will be shipped to Naval Air Stations throughout the country for re-covering purposes. The Mill also received from the Navy an initial order for Bias Tape, a new tape similar to the regular Grade A Tape, with the exception that the fabric is cut on a 45° bias to give higher tear resistance and additional reinforcement.

* * *

President George Waite of the Irving Air Chute Co., Inc., reported an increase of 180 percent in 1935 net profit over 1934. Net income in the year ended Dec. 31 totaled $336,276 against $119,799 in the same period a year ago. 1935 earnings were equal to $1.69 a share, compared with 60 cents a share during 1934.

Sales for the year climbed to $1,303,712 from $600,452 during 1934 and current assets at the end of the year increased from $912,216 to $1,097,689. Total assets amounted to $1,435,912, compared with $1,100,391 at the end of 1934.

* * *

Production of aircraft engines by Menasco Manufacturing Co., is being increased as a result of orders recently received, according to A. S. Menasco, president. Backlog of orders now on hand or in immediate prospect has reached a total of more than 75 engines which represents a volume of business in excess of $90,000 closely approximating the entire engine production for the year 1935 and exceeds in money value the total business for that year. This business represents commercial orders only and does not consider present or pending contracts with the Army and Navy.

A considerable portion of the new business was booked around the new 250 h.p. Menasco Super Buccaneer which was announced at the National Aircraft Show.

* * *

The annual meeting of stockholders of United Aircraft Corp. will be held March 6 prior to a special meeting of stockholders, to be held later the same day. At the annual meeting, directors will be elected for the ensuing year, and usual routine matters will be transacted. At the special meeting, the principal matters which will be submitted to stockholders will be the proposed increase in the authorized share capital of the corporation from 2,400,000 shares, of the par value of $5, each to 3,000,000 shares, of the same par value; the proposed offer to stockholders of such number of shares of stock as, at the offering price, will realize between $5,000,000 and $6,000,000, net to the corporation, and the proposed allocation of 50,000 shares of stock for the purchase by officers and senior employees.

A few of the exhibits at the Los Angeles aircraft show

Personnel Changes

James S. Ogsbury has been appointed vice-president and general manager of the Fairchild Aviation Corp. He will have charge of the activities of the Fairchild Aerial Camera Corp.; Fairchild Aircraft Corp.; Fairchild Aerial Surveys, Inc., and Ranger Engineering Corp.

* * *

The appointment of Charles G. Durfee as assistant to E. G. Weed, vice-president in charge of sales, has been announced by Pyrene Manufacturing Co. Simultaneously with this announcement, the company also announced the appointment of George H. Boucher, formerly assistant general sales manager, to the position of general sales manager, and J. P. Maloney, formerly assistant general sales manager, to the position of general field sales manager.

* * *

Edwin Jay Quinby has joined the public relations department of Western Electric Co. in an editorial capacity.

* * *

Charles F. Abel, of Chicago, has been appointed to serve as honorary aeronautical inspector to assist the Illinois aeronautical commission in the promotion and regulation of gliding activities.

* * *

Charles R. Burnett, Inspector for the Bureau of Air Commerce, has been transferred to the Eastern District, with headquarters at Roosevelt Field.

* * *

The Torrington Co., Torrington, Conn., and its subsidiary, The Bantam Ball Bearing Co., South Bend, Ind., announce the appointment of A. S. Hellstrom as manager of the Cleveland, Youngstown, Akron and Wheeling Districts with offices in the Caxton Building, Cleveland.

* * *

Edgar N. Gott, former airline executive is now assistant to Reuben Fleet, president, Consolidated Aircraft Corp., San Diego, Calif.

Award

Frank W. Caldwell, Engineering Manager of the Hamilton Standard Propeller Division of the United Aircraft Manufacturing Corp., East Hartford, Conn., was given the Sylvanus Albert Reed Award for 1935 for increasing the effectiveness of aircraft through development and improvement of controllable and constant speed propellers. The award consists of a certificate and $250 and was presented at the annual dinner of the Institute of the Aeronautical Sciences.

(*Continued on following page*)

Digest of Recent Events

Light Plane Speed Record for Richey

A new international light plane speed record was set by Helen Richey who covered a 100-kilometer (62.14 miles) course at Langley Field, Va., in 55 minutes or an average speed of about 68 m.p.h. Her plane was the Aeronca-powered Aeronca in which Ben King established a number of records. In a preliminary flight the previous day she bucked headwinds and completed the circuit in 50 minutes. FEB. 1

New Light Plane Altitude Mark Established

Terris Moore of Cambridge, Mass., claimed a new record altitude of approximately 12,000 ft., for light seaplanes in the third category. The flight was made over Boston Harbor. The present record is held by Jean de Viscaya of France who flew a Farman F-231 to 10,600.361 feet in June 1931. FEB. 1

England-Cape Town Air Time Lowered

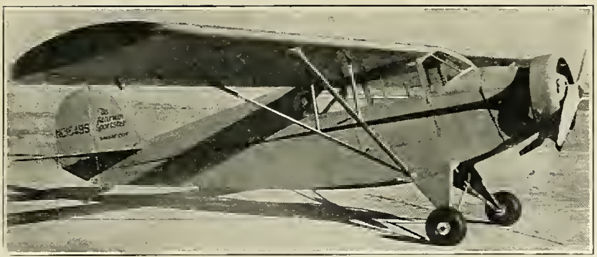
Thomas Rose bettered by more than 13 hours the mark set by Mrs. Amy Johnson Mollison when he flew from Lympne, England to Cape Town, South Africa in 3 days 17 hours 38 minutes. Mrs. Mollison's time was 4 days 6 hours 56 minutes. Rose flew solo and his record making flight was his second attempt to lower the old mark. In his first attempt he was forced down by weather in France. FEB. 9

Boeing 247-D Transport Flies 295 m.p.h.

Lou Goldsmith, flying over the Portland, Ore.,-Salt Lake City route, and accompanied by a co-pilot and a stewardess in a Boeing 247-D of United Airlines, attained a speed of almost 295 m.p.h., when his plane was helped along by tail winds which reached gale velocity. The plane covered 192 miles in 39 minutes. FEB. 7

Ione Coppedge Sets U. S. Altitude Mark

An ascent to between 14,600 feet and 15,000 feet brought to Ione Coppedge, a secretary at Wright Field, Dayton, Ohio, possession of the American altitude record for light multi-seat aircraft. Miss Coppedge, who was accompanied by Josephine Garrigus, flew an Aeronca-powered Aeronca in attaining her record. The world's record is held by Giovanni Zappetta who reached 22,805 feet in Italy in 1933. Miss Coppedge's flight was made in Dayton. FEB. 12



1936 REARWIN "Sportster"—Model 7000 A.T.C. 574
and Model 8500 A.T.C. 591

Rearwin "Sportsters" in South Africa!

Rearwin popularity is truly international! The shipment of two Rearwin "Sportsters" now on the way to Air Taxi Company, Ltd., Cape Town, South Africa, and another shipment soon to be made to Guido Hauer, Curityba, Parana, Brazil, prove international endorsement of Rearwin engineering skill, Rearwin craftsmanship, and Rearwin quality. No wonder that the Sportster is so popular at home and abroad for flying instruction and private use—it represents the utmost in modern design. Check carefully these Rearwin features: Dual controls. Commodious cabin with perfect visibility. Full 50-lbs. luggage capacity in two compartments. Head, shoulder, and leg room for everyone. Twenty-four gallon fuel tanks in wings. Twenty miles to a gallon of fuel. Unusually long cruising range of 475 miles. 70-inch tread hydraulic landing gear. 70 or 85 h.p. dependable LeBlond motors. Cruises 104 m.p.h. with speed ring. Climbs 250 feet per minute at 12,000 feet.

Compare full specifications and actual performance with other airplanes for under $3000.00—You'll see why the Rearwin "Sportster" is the fastest selling airplane in its price class.

REARWIN AIRPLANES

Eighth Successful Year

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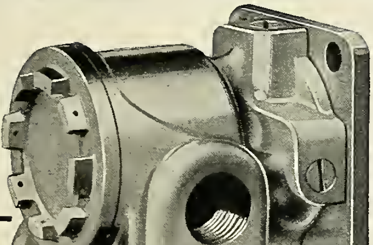

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Sherwin Williams
"MOM'S GONNA BE MAD."
"YA' HE AIN'T DOIN' SO WELL DOTTIN' THAT i."
"IT AIN'T THAT – IT'S HER BIRTHDAY AND HE PROMISED HE'D USE PINK SMOKE."

Pink smoke or no pink smoke, the pilot in this picture is doing a better job of sky-writing than we ever could. But we will bet him a ten-dollar hat that he can't make as good paint as we can. ▸ Paint making is not a one-man job. It demands the combined skill and brains of technicians, chemists and skilled workers. ▸ Some designer is always coming to us with plans for a new super-plus-special speedster to hit 300 mph. and he must have finishes that rain, sun or air currents can't beat off. He gets them at Paint Headquarters, usually from stock, because they were developed to meet such exacting conditions. ▸ Nearly fifty of the world's air marks have been made by Americans, and in many of their ships were Sherwin-Williams products. We have a finish for every aeronautical purpose. ▸ Write The Sherwin-Williams Co. of Cleveland, Ohio, for the name of our distributor in your vicinity.

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Opex Q-B Pigmented Dope
Opex Dope Thinner
Red Oxide Metal Primer
Opex Aero Enamels
Gas Engine Enamels
Airplane Spar Varnishes
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SHERWIN-WILLIAMS PAINTS

AEROPLANE FINISHES

SEE THE SHERWIN-WILLIAMS FINISHING ENGINEER

COVER THE EARTH

(Continued from preceding page)

Exports

Exports of American aeronautical products abroad during the month of November, 1935 were valued at $1,339,313 according to the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Foreign purchasers bought 26 planes valued at $315,151, 90 engines worth $448,002, and $570,051 worth of parts and accessories, not including parachutes which brought $4185. Fifty-four foreign countries and three possessions of the U. S. were represented in the number who did business with us during that month.

United Kingdom buyers imported 9 planes at $38,000 and 45 engines at $263,751 in addition to $1,758 of parts and accessories, bringing aeronautical business with this country to one of the best levels. Brazil imported 10 planes at $66,500 and the one plane delivered to a Mexican purchaser was valued at $75,000. Other planes were shipped to purchasers in Argentina (2) and Canada, British India, China and Japan (1 each). Engine sales in China accounted for 15 units valued at $77,348 and in Brazil, 5 valued at $20,026. Other engines were shipped to Germany, Mexico, Peru, Japan and Australia (3 each); Canada and Panama (2 each), and to France, Nicaragua, Trinidad and Tobago, Salvador, Colombia and Turkey (1 each).

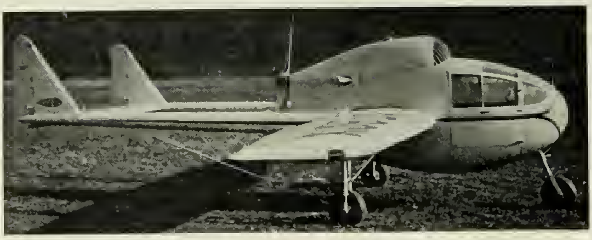
Parachutes were imported by Spain ($1,185) and Siam ($3000) and the largest importer of parts and accessories was China whose purchases amounted to $184,558. Italian imports were valued at $106,472 and other sizeable accessory sales were made to buyers in Brazil ($64,541), Soviet Russia ($53,604) and Canada ($20,675). November exports brought the eleven month total to $13,551,215.

December exports reached $926,214, bringing the total for the year to $14,477,429 compared with slightly more than $17,000,000 in 1934. During December, 14 planes and 15 engines were delivered to purchasers abroad, the total values being $537,246 and $56,103 respectively. In addition, $47,950 was spent for parachutes and $284,915 for parts and accessories.

Chamber Officials

Officers of the Aeronautical Chamber of Commerce of America, elected at the annual meeting held in New York on Jan. 31 are Leighton W. Rogers, president; L. D. Bell, president of Bell Aircraft Co.; Robert E. Gross, president of Lockheed Aircraft Corp., and C. E. Parker, vice-presidents; G. M. Bellanca, Bellanca Aircraft Corp., secretary; C. F. Barndt, Great Lakes Aircraft Corp., treasurer, and Frank J. Walsh, assistant secretary and treasurer.

The new Board of Governors includes: Rogers, Bell and Gross; Claire L. Egtvedt, president, Boeing Aircraft Co.; Reuben Fleet, president, Consolidated Aircraft Corp.; Thomas A. Morgan, president, Sperry Corp.; Burdette Wright, vice-president, Curtiss Aeroplane & Motor Co.; Donald W. Douglas, president, Douglas Aircraft Co.; J. H. Kindelberger, president, North American Aviation, Inc.; Don L. Brown, president, United Aircraft Corp.; B. D. DeWeese, president, Stinson Aircraft Corp.; Clayton J. Brukner, president, Waco Aircraft Co.; Guy W. Vaughan, president, Curtiss-Wright Corp.; Charles Marcus, vice-president, Bendix Aviation Corp.; E. D. Osborne, president, Edo Aircraft Corp.; Sherman M. Fairchild, president, Fairchild Aviation Corp.; George S. Wheat, vice-president, United Aircraft Corp.; Walter Beech, president, Beech Aircraft Co.; Charles L. Lawrance, president, Lawrance Engineering and Research Corp.; Harold F. Pitcairn, president, Pitcairn Autogiro Co.; Oliver L. Parks, president, Parks Air College; George Orr, president, Roosevelt Field; John H. Jouett, Standard Oil Co. of New Jersey; Robert J. Pritchard; Reed M. Chambers, vice-president, U. S. Aviation Underwriters; Fred Sheriff, president, National Association of State Aviation Officials and Richard H. Depew, Jr.



Two-place all-metal Campbell monoplane powered by a Ford V-8 engine

New Craft

Campbell Aircraft Co., St. Joseph, Mo., has just completed and flown an interesting all-metal, two-place, three-wheeled pusher-type monoplane powered by a Ford V-8 engine. New in construction is the wing which is of the full cantilever type, of multi-cellular box spar construction with a system of stiffeners in the skin, the front spar having a light nose-structure.

Seating is of the side-by-side arrangement; the control column is of the throw-over type, and the dual rudder pedals are adjustable and removable. Tail surfaces are carried on booms which are of monocoque construction and which are attached to the rear of the wing spar.

The plane is expected to show a maximum speed of 120 m.p.h., cruising speed of 100 m.p.h., and landing speed of about 55 m.p.h.

* * *

Timm Aircraft Co. have received a contract from the Crusader Aircraft Corp. to manufacture the Crusader airplane in their Grand Central Air Terminal shops. T. M. Shelton representing the Crusader Company, formerly known as Giro Airlines, Inc., of Denver, Colo., signed the contract with Timm.

The plane to be produced will be the second aircraft of a new design. The first plane, a four passenger craft, was flown to the Pacific Coast during a nationwide demonstration tour about two months ago and was again brought to the coast for the Los Angeles Aircraft Show.

The new model is designed to accommodate six persons, will have a retractable landing gear and will be powered by two Menasco 250 h.p. engines. The two models will be alike, however, in their general appearance. Two booms extending to the rear of the engines support the tail surfaces and a short streamlined body mounted on the wing between the booms carries the tail wheel. The new plane, which will be of all-metal construction, will have a speed in excess of 200 m.p.h. according to Otto Timm.

Manufacture of the *Crusader* in no way will affect Timm's plans to go into the production of their own aircraft, a small bi-motor transport. Timm also will continue to operate their overhaul business.

Sales

Aircraft Industries took delivery of two new Stinson SR-7s during January. The last plane, which was received late in the month, was a special job which was exhibited at the Los Angeles Aircraft Show.

* * *

Receipt of an order from Harold E. Neumann for a supercharged Menasco aircraft engine to be installed in a new speed plane now under construction, brings to five the total of supercharged engines being constructed in the Menasco aircraft engine plant for use in racing planes according to A. S. Menasco, president of the company.

* * *

The first Fairchild 91 Amphibion has been delivered to Pan American Airways at the International Airport, Miami. Called the *Jungle Clipper*, it is powered with a 750 h.p. Pratt & Whitney Hornet engine. In addition, a second ship, this one powered with a 760 h.p. Wright Cyclone, is to be delivered to Pan American soon for use on the Yangtze River in China.

Coming Events

The Intercollegiate Flying Club is sponsoring the Second National Intercollegiate Flying Conference which will be held in Washington, D. C. Mar. 31-Apr. 1.

•

Closing date for entries in the Seventh Annual W. E. Boeing Scholarships, Boeing School of Aeronautics, Oakland, Calif. Mar. 15, 1936.

•

An International Aero Exhibition will be held in Stockholm, Sweden. May 16-June 1, 1936.

•

The Seventh Annual Soaring Contest will be held at Elmira, N. Y. under the auspices of the Soaring Society of America. June 20-July 5.

•

The Coupe Armand Esders speed race will be held over a route between Deauville and Cannes, France. July 25.

•

1936 National Air Races will again be held at Cleveland Municipal Airport. Sept. 4-7, 1936.

•

The Deutsche de la Meurthe Cup Race, under the auspices of the Aero Club of France will start from the Etampes Montdésir Airport. Sept. 13.

•

A 7060-mile round-trip speed and handicap race between Paris and Saigon, and sponsored by the Aero Club of France, will start from an airport near Paris. Oct. 1936.

•

15th International Aeronautical Salon is scheduled to be opened at Grand Palais, Paris, November, 1936.

"Cheer up Joe—your work will show improvement, too, when you start using the new Glidair Finishes."

The Glidden Company offers to the aircraft industry a new line of Pigmented Nitrate Dopes. HIGHER LUSTRE—CLEANER COLORS—INCREASED FLEXIBILITY—EASIER POLISHING—EXCELLENT WEATHERING QUALITIES—*Write for free booklet.*

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Your instructors are specialists with from 10 to 24 years of experience in the industry. And they are able to give you *more hours of individual attention.* (Boeing School's staff includes more licensed ground instructors than any other air school in the country.)

In the "Airline Mechanic"—one of 4 ground courses—you cover *theory* in classrooms and laboratories; practical work in 7 modern shops: Radio, Maintenance, Power Plants, Woodworking, Welding & Metals, Fabrication & Design, and Instruments. You become familiar with industry practice through actual hangar service at Boeing School.

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*Name*________ *Age*________
*Years in High School*________ *Years in College*________
*Address*________ *Phone*________
*City*________ *State*________

FOREIGN NEWS IN BRIEF

Australasia

Quantas Empire Airways Ltd., report an increase of business on its portion of the England-Australia route. Passengers and freight have been turned away and mail has reached record proportions. When service was inaugurated, the official estimate of mail was 200 lbs. a trip, whereas the mail has averaged 800 lbs. a trip inward, and 650 lbs. outward.

Amalgamated Wireless, Ltd., is to erect a radio direction beacon at Mascot, in order that blind landing experiments may be carried out by radio.

The R.A.A.F. is to acquire six twin-engined Avro *Anson* bombers, fitted with 300 h.p. Armstrong Siddeley *Cheetah* engines. The machines, the most modern yet acquired for the Service, are of the latest type as supplied to the British Royal Air Force.

The first year of operation of the England-Australia scheduled service was completed Dec. 10, 1935. From the inauguration of the service to Sept. 30, 1935, it was reported a total of 20,134 lbs. of mail was carried from Darwin to foreign destinations; the incoming mail passing through that coastal point during the same period amounted to 25,891 lbs. When the service was inaugurated it was estimated the average load of mail during the first year would be 200 pounds; actually it has averaged 640 lbs. outward and 800 inward. These averages exceed the estimated average loads for the sixth year of operation.

Canada

In recognition of his exploits over the front lines during the World War, Lieut. Col. W. A. Bishop has been appointed Honorary Air Vice-Marshall in the Royal Canadian Air Force. The appointment marks the first time the rank of Vice-Marshall has been conferred to the Canadian Air Force. Equivalent ranks have been conferred in other branches of the service.

Air Vice-Marshall Bishop has been rated among the greatest of all aces of the war. He shot down 72 identified German airplanes and no doubt accounted for others which fell behind the German lines and could not be identified.

Canadian companies are flying more freight and express than those of any other country in the western hemisphere. Millions of pounds of express are carried annually, practically all of it in or out of the northern regions of the Dominion. For the first six months of 1935 complete figures are not yet available for all Canadian transport operators, but the largest company flew 2,426,962 lbs. of express and freight. The year before Canadian planes carried 14,441,179 lbs. of express and freight, according to official government figures.

The Canadian Flying Clubs Association, composed of 22 light airplane clubs, recently held its annual convention in Hamilton, Ontario, and elected as honorary patron the newly-appointed Honorary Canadian Air Vice-Marshall, Lieut. Colonel W. A. Bishop, V.C. Dr. E. A. McCukser was elected president; with W. G. Mackenzie vice-president for the Pacific zone; W. A. Cooper, vice-president for the Western zone; J. Dobson vice-president for the Centre zone; G. R. McGregor vice-president for the St. Lawrence zone; and Victor O. Mader vice-president for the Maritime zone. Major General Sir James H. MacBrien, commissioner of the Royal Canadian Mounted Police, was appointed honorary president. The medal annually given by the Association for meritorious service by non-professional pilots was awarded to Squadron Leader W. A. Curtis, D.S.C.

The Ontario Provincial Air Service, government operated fire-fighting and forestry service, reports building two more Buhl airplanes similar to the one built last year at the Service's Sault Ste. Marie plant. The Service also reports more government officials and police using the planes during the winter months to reach otherwise inaccessible points in northern Ontario.

Czechoslovakia

An extensive airport program of construction and improvements has been prepared by the Ministry of Public Works. The 1936 program provides for the erection of hangars and other buildings on the Ceske Budejovice, Liberec (Reichenberg), Brno (Bruenn), Bratislava, Piestany, Zilina Avolen and Uzhorod airports. Concrete aprons will be provided at Karlsbad and Marienbad; roads and communications facilities will be improved where necessary. The Uzhorod airport will be lighted, and beacon towers will be erected at Bratislava and Uzhorod. Construction of the auxiliary field at Krizanov will be continued and leveling work on a number of auxiliary fields will be started.

During the winter, Czechoslovak Air Transportation Co., will continue to operate the Prague-Leipzig-Rotterdam-Amsterdam service in cooperation with KLM. Over this route a traveler may go between Prague and London in less than 7 hours, in tri-motored, 14-passenger Fokker F XVIII planes.

It is planned to improve service between Prague and Yugoslavia and Rumania by extending the airline from Zagreb and Susak to Split and by introducing daily service between Prague and Bucharest. The proposed service between Prague and Moscow is expected to be inaugurated in May. Services between Czechoslovakia and Austria, Germany, France and the Netherlands will be maintained on the present scale without substantial changes. Difficulties are reported in supplying Czechoslovak air transport companies with flying equipment of domestic make. With the exception of Fokker planes, made locally under license, it is said there is not a suitable plane made in the country for transport work.

Wright-powered Noorduyn "Norseman" built in Canada for transport operations

France

The town of Le Touquet is asking for bids for work to be done at the La Canche airport which it is expected to open this year. Two hangars, a club house, supply and repair shops, etc., will be provided. Cost of improvements is estimated at $50,400. The airport measures 2,461 by 2,133 ft.

Air France has speeded up its schedules on most routes so that in most instances one hour or more is saved; flight time on the Marseilles-Algiers sections has been reduced two hours. Between Paris and London there are two round-trips per day and a third was started March 1. The Marseilles-Cannes service has been interrupted due to the condition of the Cannes airport but work is being done there to permit its renewal. The Paris-Madrid service, operated in cooperation with the Spanish Air Mail Line, will be continued throughout the winter. Air France is continuing efforts to renew its equipment and it is expected more new planes will be purchased.

By a degree of the Air Ministry a Flight Test Committee, charged with directing tests of experimental air material for use by the Government or enterprises under state control has been created. The committee is appointed by the Air Minister and meets once a week to adopt a fiight test program for each experimental type, hear the reports of its members following tests and submit a final report in each case. The committee has at its permanent disposal test centers placed under the Division of Aeronautical Manufacture to execute technical and employment tests provided.

Air Bleu Co., which inaugurated postal service on July 10, 1935, is now operating five lines which, starting from Paris, connect with Lille, Le Havre, Nantes, Bordeaux and Strasbourg. A Paris-Marseilles line will also be put into service. Since its establishment this company has covered 37,284 miles in 2,200 flying hours.

The Aero Club de France has entered for competition the Deutsch de la Meurthe Cup which

(*Continued on following page*)

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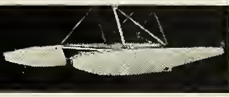

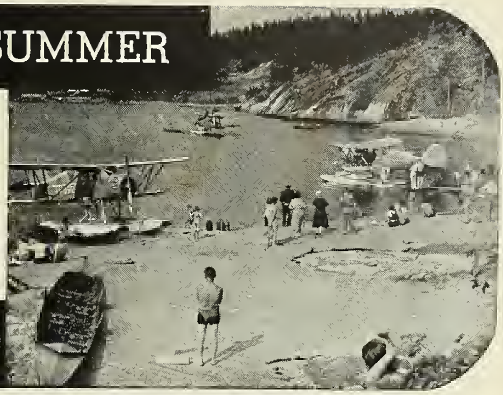

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(Continued from preceding page)

it permanently won after three consecutive victories gained by France in 1933, 1934 and 1935. This international speed trial, which will take place on Sept. 13, will be run over 2000 kilometers in two stages of 1000 kilometers each and over a 100-kilometer circuit. The airport of departure and arrival will be Etampes Montdésir.

The Aero Club of France is organizing a speed and handicap speed race over the Paris-Saigon-Paris route. Departure is fixed for Oct. 25. This race is endowed by the Air Minister with prizes of art objects and the sum of 1,200,000 francs, reserved for the purchase of the winning plane, be it of French or foreign make, the eventual sale of the plane, however, being left to the choice of the constructor.

To reach Saigon a distance of 6,618 miles will be covered while the return trip represents a flight of 7018 miles. The following rules are provided: (1) minimum crew of two men for the speed race; (2) two-way radio; (3) minimum range of 2,923 miles must be effected over part of the course.

The handicap event is only open to multi-motored transports able to fly at full load with one of its engines shut off at an altitude of at least 6500 ft.

The Coupe Armand Esders, an international competition, consisting of a speed race over the Deauville-Cannes-Deauville route and open to landplanes of any type, will start July 25. The race carries prizes totaling 200,000 francs, offered by M. Armand Esders, 100,000 of which goes to the winner.

Germany

A new wind tunnel has been erected at Adlershof airport, Berlin. One section, devoted to testing engines has two upright columns at either end of the tunnel for air intake and exhaust by the action of the engines being tested. Beside the tunnel are small rooms with insulated walls and windows through which engine action is observed. The airplane testing tunnel lies along the ground and is 410 ft. long. A 27 ft. propeller rotated by a 2,700 h.p. electric motor gives airflow speeds of 155 m.p.h.

Focke-Wulf Aircraft Co., presents a new type of twin engined training airplane, designed to cover twin-engined and blind flying, radio, gunnery and bombing. Known as the Fw 58, it is a low-wing monoplane powered with two air-cooled Argus As10C engines rated 240 h.p. at 2000 r.p.m. and equipped with wooden propellers.

Argus-powered Fw. 58, a German twin-engined training plane built by Focke-Wulf

The fuselage is of chrome-molybdenum tubular type, faired and fabric covered. Wings have a single beam built of duralumim and ribs of the same material, fabric covered. Tail surfaces are of metal except for fabric covering. Landing gear is fully retractable, each wheel retracting aft into the engine nacelles. The airplane is equipped with flaps and trimmer tabs. The interesting feature is the use of rather high aspect ratios of about 10 and 4.5 for the wing and horizontal tail surfaces respectively.

Data and performance are as follows: wing span, 69 ft.; wing area, 565 sq. ft.; empty weight, 4160 lbs.; useful load, 2020 lbs.; gross weight, 6180 lbs.; maximum speed, 158 m.p.h.; cruising speed, 146 m.p.h.; service ceiling, 17,100 ft.; range, 416 miles.

Great Britain

A squadron of four-engined Short flying boats at Singapore will begin sometime this month, the first Royal Air Force cruise to Japan. The return to Singapore is timed for about a month later, after a flight of more than 7,000 miles. On the outward voyage the planes will go via Kuching and Kudat in Sarawak to Manila and then on to Hong Kong, Amoy (China), Shanghai, Kagoshima, Tokyo and Takyama or some other place approved by the Japanese government. The squadron will stay in Japan for about a week. On the return, they will follow the same route as far as Hong Kong, and will then follow the coast to Cochin China to Singapore with one stop at Kam Ranh Bay.

Details are now available on the new fleet of large planes ordered by Imperial Airways for future use on the London-Continental and Empire air routes, which will be expanded under the government plan to have all first-class mail carried by air within the next two or three years. Forty-one planes, 29 flying boats and 12 land-planes are under construction or on order. They will be more pretentious in interior arrangements, and offering living conditions which will vie in faster than earlier comparable craft, cruising long distances nonstop at speeds of 150 m.p.h. and more.

The Armstrong Whitworth landplane is a high-wing monoplane powered with four Siddeley *Tiger* engines, with a total h.p. of more than 3,000. It carries 27 passengers by day, and 20 by night in sleeping berths. It has three cabins, a mail compartment, kitchen, two lavatories, luggage compartment, a ship's office and pilots' compartment. Two passenger saloons are behind the wings and one is in front; the mail compartment and kitchen are approximately in line with the wings.

The new Short monoplane carries 24 passengers in day-time operations and 16 as a sleeper for night operations. There are upper and lower decks and four passenger cabins, a freight compartment, kitchen, two lavatories and, on the upper deck, the bridge.

Several British air transportation companies are interested in establishing direct air service between London and Copenhagen and these companies are now endeavoring to obtain an appropriate concession from the Danish Government. One of the companies, recently organized, is British-Scandinavian Airways, capitalized at $330,000. This company plans to operate 8-passenger planes capable of 205 m.p.h. and of flying between London and Copenhagen in 3 hours. Service may be inaugurated this spring.

Holland

From November 2 to April 29, the European section of the Royal Dutch Air Lines service to India is changed to provide for stops at Marseilles, Rome and Athens. A more northerly route, via Budapest, Bratislava and Leipzig, is followed throughout the remainder of the year.

The annual report of Royal Dutch Airlines for 1935 reveals that the company transported more than 100,000 passengers during the year. In 1934 the line carried 86,000 passengers. European passengers in 1935 totaled 96,000; the Batavia line carried 1,540, while 2,700 traveled on the West Indies line. Freight increased from 1,063 tons in 1934 to 1,320 tons last year. Mails carried on the European line increased 65 percent and 34 percent on the Batavia line.

Mexico

Reports of the Ministry of Communications and Public Works show that passengers carried by transport planes in Mexico increased from 171 in 1923 to 51,558 last year. Transport planes flew 16,964.4 miles in 179 hours in 1923, and 3,968,167 miles in 35,178 hours in 1934.

Reorganization, modernization and expansion of military aviation units are to be undertaken in a four-year term, starting this year, at a cost of approximately $1,400,000. The program includes an initial purchase of ten planes, the Ministry of War and Marine considering seven different types of American manufacture.

Russia

New Soviet all-metal multi-motored passenger planes of higher speed and greater capacity will be placed in service early this summer on the Deruluft airlines operated jointly by the Soviet Union and Germany.

Negotiations are now going on between Deruluft and air companies of France, Switzerland and other European countries to coordinate schedules so as to provide Deruluft passengers uninterrupted passage within 24 hours from Moscow or Leningrad to London, Paris, Amsterdam, Brussels, Stockholm, Barcelona, Vienna, Copenhagen, Budapest and Prague as well as principal German cities.

New mail and passenger airlines, the joint length of which will be 3400 miles, will be opened this year. The longest line, to be opened in the spring, will extend from Moscow to Alma Ata, a distance of 1860 miles and will serve such important industrial and administrative points as Kazan, Ufa, Magnitogorsk, Karaganda and Balkhashstroi. Also in the spring another route will be opened between Odessa and Batum, serving various seashore points along the Black Sea coast.

Lines between Moscow and Sebastopol, via Kharkov, between Moscow and Odessa via Kiev, and from Moscow to Saratov via Penza are expected to open during the first half of the year.

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TRADE LITERATURE

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Electric Tools

Independent Pneumatic Tool Co. has just issued catalog #32 which illustrates and presents specifications on the entire Thor line of Universal electric tools. In addition to the regular line of tools, this catalog contains the new U-14, a small portable electric tool which is half the size of other portable electric tools of the same capacity, but with the same power. This tool was described in the September, 1935, issue of AERO DIGEST. The catalog includes a complete showing of portable drills, screw drivers, hand grinders, bench grinders, nut setters, tappers and saws.

Precision Bearings

Norma-Hoffmann Bearings Corp., Stamford, Conn., has issued *Precision Needle Roller Bearings,* a new catalog describing the latest addition to this company's line of precision bearings. This type of bearing is particularly adaptable to conditions where minimum outside dimensions, minimum weight, concentrated load capacity and dependability are requisites. These precision needle bearings in metric sizes from 12 to 150 m/m bore are applicable to a wide range of loads and speeds, and can be used in conjunction with connecting rods (wrist pin end), cam rollers, rocker arms, pump shafts, idler gears, planetary reduction gears, aircraft engines, and miscellaneous machine purposes.

Radio

The first issue of *Pick-Ups* has been issued by the Western Electric Co. The introductory editorial states that the magazine will be devoted to news of developments in the field of sound, and of the organizations and men who use the equipment designed by Bell Telephone Laboratories, manufactured by Western Electric and distributed by Graybar.

In this initial number there are 26 pages with a two-color cover depicting the new non-directional dynamic microphone. Articles deal with the microphone, WTCN's new 5,000-watt station at Minneapolis, new radiophone equipment for pilots, the work of Bell Laboratories, a two-way ultra-high frequency police radio installation at Evansville, Ind., and the wide-range public address system at the California Pacific International Exposition. The issue is copiously illustrated. The publication will be issued several times a year and will be circulated chiefly to users of Western Electric equipment such as broadcasting stations, police departments and air transport companies, as well as to prospective users.

Weather Instruments

An interesting booklet describing its products for ascertaining weather conditions has been issued by Julien P. Friez & Sons, Inc., Baltimore. Titled *Wind News,* this publication is well-illustrated and expertly put together. It provides the reader with a comprehensive coverage of practically every type of weather recorder, and illustrates how and where various instruments are installed.

History of Bakelite

Commemorating the twenty-fifth anniversary of the organization of the Bakelite Corp., a 48-page jubilee edition of *Bakelite Review* has been issued.

The book is interesting and entertaining. It traces the development and history of this industry and tells how bakelite and its products are applied to other industries, including aviation. Today there are more than 2000 different varieties of Bakelite material covering a wide scope of application and use.

Stampings

Folder E, describing and illustrating typical aircraft spinnings and stampings, has just been issued by Teicher Manufacturing Corp. An interesting presentation, it shows 8 stampings and 5 spinnings. It gives a brief description of each part shown and offers a blueprint of a one-piece seat for pilots.

Diesel Questions

Couched in a simple, direct way and avoiding technical discussion throughout, a new rotogravure booklet, the *Whys and Hows of Diesel Engines,* has just been issued by Caterpillar Tractor Co. of Peoria, Ill. Principal topics are headed, "Why the Diesel?", "How Does the Diesel Run?", and "What Do Owners Think?". The cover reproduces photographs of a Diesel tractor, streamlined trains and a Diesel-powered submarine, and the text is interspersed with illustrations.

Fafnir Bearings

A comprehensive discussion of the bearing problems of machine spindles, and of the types of extra-precision ball bearings required in such applications, has been prepared by the Fafnir Bearing Co., New Britain, Conn. The new bulletin *Super-Precision Ball Bearings for Spindles* describes specifications and methods of application of the pre-loaded type of bearing required to eliminate shaft or spindle displacement under load.

A review of the development of the pre-loaded duplex bearings, and of the various types and arrangements now available, is featured. Sectional drawings of typical types of machine spindles show the bearing arrangements required to meet specific conditions of accuracy and load on high-speed grinders, engine lathes and other precision machine tools.

Aircraft Cable

Macwhyte Co., has recently prepared a new catalog in which information helpful in specifying aircraft cable is included. In addition to giving this information, the catalog explains the fundamentals of cable purchasing under the divisions of dimensions, construction, fabrication, and material. Specification tables on the size, strength, weight and material of Macwhyte cable for aircraft further enhance the value of this pamphlet.

Aircraft Bearings

Norma-Hoffmann Bearings Corp. has reduced the page size of its booklet *Precision Bearings for Aircraft,* but the new edition F-945, contains 8 additional pages of new material representing the latest developments in special bearings for aircraft use.

In this bulletin will be found descriptions, tabulated specifications, and load ratings of the types of precision bearings most commonly used today in the various aircraft controls. Brief mention is also made of other types of precision bearings used in various applications elsewhere in the industry.

Paint

Prepared with the cooperation of the Better Vision Institute and Better Light-Better Sight Council, the new Sherwin-Williams *Save-Lite* catalog is a factual presentation of painting as a part of lighting and plant conditioning. In a concise manner it tells what a wall and ceiling paint should be, and its importance as an aid to better and more economical production.

Other features of the new catalog are illustrated laboratory studies, industrial applications, case histories, charts on lighting standards and plant interior paint uses and applications.

PERSONAIRLITIES

(*Continued from page* 51)

tracks on the other side, following the wrong one, as it turned out, and ending up in the Alleghenies in a flock of big solid clouds, from which he descended via parachute. Once Birdie Wright got the airways mapped out, Army pilots occasionally flew by compass and discovered two Army fields several miles off the railroad that they'd never before even suspected were there.

From January, 1925, until July, 1927, Captain Wright was on duty at Kelly Field as Director of Flying Training at the Air Corps Advanced Flying School, and other duties such as Operations Officer. In the summer of 1927 he was assigned to the Office of Chief of Air Corps as Chief of the Information Division, where he had to associate with a lot of low reporter fellows from newspapers. This so discouraged him that he resigned from the Army in January of 1928, being commissioned a Major in the Air Corps Reserve.

Upon his resignation he became connected with the Curtiss Aeroplane & Motor Co., in charge of their Washington office, later becoming vice-president of that company and, following the merger of the Curtiss and Wright interests, vice-president of the Curtiss-Wright Corporation. In June, 1933, he was sent to Buffalo to join the staff of the Curtiss Buffalo plant, and continued there in sales and production work until January of this year when he was designated vice-president and general manager in charge of the Curtiss Aeroplane & Motor Co. Now that Major Wright is in charge of the airplane production of Curtiss, it is expected that he will bring the production end up to the high point of efficiency reached by the sales and publicity departments.

For his work during the war Major Wright received the American Distinguished Service Cross, the Belgian Order de la Couronne, the French Croix de Guerre with Palm, and citations by General Pershing and General Mitchell. In order to secure all this assorted ironware, the much-decorated Mr. Wright performed many a neat feat of valor, raising hell with the Hun at Chateau Thierry, in the Champaigne sector, and in the St. Mihiel and Meusse-Argonne offensives. Of course, he was young at the time, and didn't know any better.

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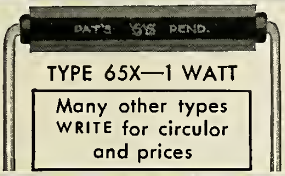
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PROSPECTS RECORDS

(Continued from page 26)

course a form used by a transport company. On the visible margin there is space for the name of the account, a 25 to 100 scale over which a progressive signal slides to its correct reading according to the percentage of volume obtained this year as against last year, and several boxes to the right which read "Travel Plan," "Traffic Manager," "Past Passenger," "Prospect," "Air Express," "Mail and Scrip Book." As soon as any of these is accomplished, it is either X'd out or a small signal is placed over that one. The matter on the body of the card is easily understandable and is not only important but essential to any operating company. There is space at the bottom devoted to a yearly recap of sales; first by the office operating the record and second a national figure. This will give the local office a picture of the volume of business they are getting from that concern. The spaces under "volume this office" can be divided into quarters to show a recap by quarters if desired. Figure 5, called a work sheet, contains a digested report of all trips taken by individuals who are members of the company being considered. It is a columnar ruled piece of paper that folds over the form in figure 4. The headings are blank and are filled in as required; per sample, Miller.

8/2 A 48—which means that Mr. Miller of the company took a trip on August 2 over route A and it cost his company $48.

A more or less complete listing of equipment that the office equipment industry has to offer the Aviation industry would contain, first, the seven major classifications: 1—Sales records; 2—Stock records; 3—Filing; 4—Ledger; 5—Furniture; 6—Safes and protective devices, and 7—Miscellaneous.

Subdividing these we have:

1—a. Kardex cabinets; b. Sales record cards; c. Steel card files; d. Wood card files; e. Guides; f. Binders (visible and loose leaf); g. Indexes; h. Loose leaf sheets (all reports and charts); i. Management control book units (zipper type); j. Prospect cards; and k. Salesman's reports.

2—a. Kardex cabinets; b. Stock record cards; c. Bin cards; d. Loose leaf sheets (all forms i.e.: requisitions, etc.); e. Steel card files; f. Wood card files; g. Guides; h. Binders (visible and loose leaf); and i. Indexes.

3—a. 5, 4, 3, 2, and 1-drawer steel files; letter; legal; card; document and all other sizes; b. Counter equipment; c. Map and plan unit files; d. Sorting trays; e. Transfer cases; f. Variadex; g. Triple check; h. Alphabetic, geographic and subject files; i. Morgues; j. Folders; (See also #6); and k. Newspaper files, pamphlet binders.

4—a. Binders; b. Ledger trays; c. Loose leaf sheets i.e.: Accounts receivable and payable, general ledger expense, payroll, balance, voucher, petty cash, journal, etc.; and d. Indexes.

5—a. Desks (wood-steel); b. Chairs (wood-steel-aluminum-upholstered-leather); c. Letter trays; d. Lamps; e. Hat racks; f. Humidors; g. Ash receivers; h. Book cases; i. Lounges; j. Benches; k. Steel shelving; l. Bins; m. Counters; n. Lockers; o. Storage cabinets; and p. Railings.

6—a. Safes (safe-cabinet); b. Safe desk; c. Safe files and certi-files; d. Drawer safe; and e. Burglar chests.

7—a. Telephone switchboard equipment; b. Specially drawn forms; c. Roster boards; d. Flexifiles; e. Typewriters; f. Dexigraph; and g. Indexing and servicing department.

This is a partial listing for there are so many ramifications of almost every item here that space would not permit their detailed discussion or outline at this time.

Aviation schools would do well to add to their courses a lecture or two on record keeping so that future executives throughout the industry will be better equipped with a knowledge of the standardization of records and record keeping.

SUMMARY OF TECHNICAL PAPERS

(Continued from page 35)

charts similar to the one reproduced. It was interesting to note the similarity of the cost versus quantity variation in the automobile and the airplane but only the future can prove or disprove the accuracy of the curves beyond a certain quantity since the curves of necessity are of empirical nature.

W. R. Weems of M.I.T. spoke on *The Effect of Tubing on the Indicotions of an Airspeed Meter.* The investigation was conducted at M.I.T. in cooperation with W. A. Reichel of the Pioneer Instrument Co. and consisted in laboratory experiments paralleled with analytical studies. The results of this investigation led the speaker to conclude that, "the connecting tubing of an airspeed meter behaves essentially as a capillary; the theory of the one-dimensional system can be used to predict satisfactorily the response of a given meter and tubing installation to an arbitrary variation of airspeed; for ordinary installations of standard 3/16" tubing, no appreciable error is introduced by the tubing, and 1/8" tubing may be used for most cases, with a saving in weight; the smaller tubing may be further useful in damping out vibrations of the enclosed air column, which can cause unsteadiness of the pointer if 3/16" tubing of length in the range 25 to 50 feet is used."

L. P. Harrison of the U. S. Weather Bureau presented a paper on *Use of Barometric Pressure for Setting Sensitive Altimeters in Airway and Airport Traffic Control.* This treats the contemplated use of pressure measuring instruments employed in the airway weather service for the purpose of obtaining pressure settings pertinent to the various airports and relaying it to aircraft in flight. The speaker felt that it is highly desirable to establish suitable equipment on mountain peaks and other strategic elevated points, these automatic units to emit periodically, at short intervals, the identification or call letters of the station, the actual altitude and the corresponding altitude setting.

A. R. Stickley also of the Weather Bureau spoke on *Feasibility of Winds Aloft Observations at Sea.* He described the conditions and requirements of these observations and advanced some recommendations with the view of improving the American methods such as: the increase of the stability of the theodolite, the use of larger balloons, and the use of a radio-meteorgraph to give wind directions and speed in and above cloud layers as well as below them.

Edwin P. Hartman of NACA presented a paper on *Considerations of the Take-Off Problem,* which stresses the importance of the accurate determination of the propeller thrust in the latter part of the take-off run rather than only the static thrust. The speaker recognized also the importance of the attitude of the plane during the take-off.

M. N. Gough of NACA spoke on the *Technique of Landing Airplanes Equipped with Wing Flaps.* The speaker stressed the following points: the maintenance of a sufficient margin of speed above the stall; a decisive use of the controls at the proper time; more cautious use of power during the approach glide; and, above all, the willingness to accept the steep nosedown attitude necessary in the glide resulting from the use of flaps.

The two other papers presented were by Kendall Perkins of the Curtiss-Wright Airplane Co. on *Dollar Value in Aircraft Design* and Luis de Florez on *A New Method of Blind Flight by the Sense of Hearing Alone.*

Afternoon sessions were on Aeronautical Meteorology and High Altitude Problems the first with W. R. Gregg as chairman, and D. W. Tomlinson as chairman of the second. Michael E. Gluhareff of Sikorsky Aircraft who participated in the discussion on high altitude problems stressed the importance of aerodynamic cleanness in stratosphere planes.

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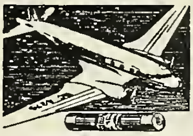

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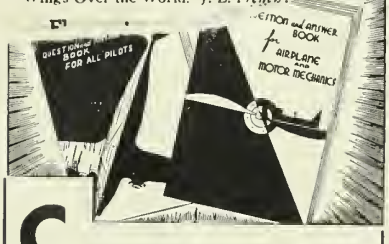
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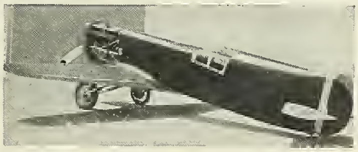

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WACO CABIN: 14 months old; new condition throughout; bargain. Waco F: 125 Kinner; ship, engine just major overhauled; perfect, $1,800. Kinner Bird: Hand rubbed finish, recently majored, new propeller, compass, airspeed, $1,300. Taylor Cub: 8 months old, demonstrator, $950. OX Waco: Recovered, airwheels, Scintilla magneto, new engine, $500. American Eaglet: New propeller, extras, $450. Meinke-Eldred Flying Service, Willoughhy, Ohio.

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PLANES FOR SALE: Waco 10, newly covered, air wheels, steel propeller. Stinson Jr., slightly damaged, J6-5 powered. Kingsville Cabinet Shop, Kingsville, Missouri.

SIKORSKY S-38: Two new Wasp C engines; 30 hours total time. Ship fully equipped and just overhauled by P.A.M. and never been in salt water. Guaranteed to be in better condition than new ship. $8,250. Mouton & Six, San Franciso Airport, San Francisco, California.

BRAND NEW $20,000 FAIRCHILD 71 for $7,500. 7-place. Electric starter, generator, flares, landing lights, "blind" instruments, tail wheel, 240 gallon tanks, folding wings; 2,351 pound useful load; Wasp motor, KE valves, forged pistons. 145 top. A rare buy. Western Airplane Distributors, 600 Graphic Arts Building, Kansas City, Missouri.

CHALLENGER ROBIN: Just relicensed until December 4, 1936, $895; $450 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

WACO 1935 CUSTOM CABIN: Jacobs-powered; new condition; special paint, hand-rubbed finish; radio, landing lights, flares, extra instruments; less than 200 hours; engine just factory top overhauled; $5,500. Selling to replace with new model for business purposes. J. Story Smith, Jacobs Aircraft Engine Company, Pottstown, Pennsylvania.

LATE 1935 AIRPLANES at reduced prices. Porterfield, Taylor Cub, J-6 Travel Air, Taylor Chummy (less engine), Kinner K-5 engine, Cirrus parts. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

GREAT LAKES: Excellent condition. 85 hours since entirely recovered and motor majored by approved repair station. Has pants, semi-airwheels, brakes, Hamilton propeller, landing and navigation lights, bank and turn, compass and airspeed. Sell reasonable or trade on Stinson S. or SM8A in good condition. Gordon Kilmer, 829 Leith, Flint, Michigan.

WACO UKC CABIN: Continental motor: 250 hours total time; special paint job; two-way radio; special instruments; ship and motor like new. Tom Melton, Municipal Airport, Denver, Colorado.

TWO OX WACO 10's; one 3-place Swallow. Ships equipped with Miller overheads, airspeed, pitch, bank, etc. No better performing OX jobs on the market. Reasonable. Take late motorcycle. Want Aeronca. Waco F or similar ships. B. A. Hutton, Brewster, Kansas.

LATE 210 H.P. CONTINENTAL Waco cabin: Also 210 h.p. Continental Waco F-2 and new Taylor Cub. Excellent condition. Many extras. Paul Peterson. 2503 Union Ave., Altoona, Penna.

AVIAN: Cirrus-powered with American conversion. 440 hours total; 205 since major. Slots and folding wings. An excellent trainer, $5[illegible]5; $295 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

FAIRCHILD KR-21-B: All overhauled and recovered, with Kinner B-5, top overhauled. Spent $450 on ship last August. Always privately owned. New steel propeller. Pioneer turn and bank. Compass, airspeed, airwheels, brakes. Ship in perfect condition, equal to new. $1,500. Wm. H. Wilhelm, P. O. Box 792, Alliance, Ohio.

FOR SALE: Waco Cabin, 1934, Jacobs motor, wood propeller, bank and turn, rate of climb, clock, flares, landing lights, radio, 70 gallon tanks, electric starter and generator, ship like new, colored Insignia blue; $3,750. Muncie Aviation Corp., Muncie, Indiana.

PORTERFIELD FLYABOUT: Latest model, sacrifice. District of Columbia, Maryland, Virginia distributor. Trades or finance. Dick Schall (College Park Airport), Berwyn, Maryland. Telephone: Berwyn 385.

FOR SALE: 1932 Continental 210 Waco Cabin; Warner Waco F; Curtiss Jr., Stinson Reliant. Complete set Travel Air 2000 wings, and other parts; Waco 10 parts; pair D-H wheels and tires. Fox Valley Flying Service, Aurora, Illinois.

LAMBERT MONOCOUPE: 35 hours since complete major. Steel prop, navigation lights, airspeed, booster, heater. Licensed; excellent condition; $1,400. Walter Maier, General Delivery, Palm Beach, Florida.

BUHL BULL PUP: Szekely 45; 80 hours; airwheels, airspeed, new condition; licensed to February 1937, $495. Charles M. Snyder, Oak Avenue, Lockport, Illinois.

FOR SALE: American Eagle monoplane: Practically new, roomy 4-passenger cabin; mohair upholstering; lots visibility; steel prop; Bendix brakes; 70 gallons gas; folding wings; Continental motor; must see to appreciate. OX Waco 10: Nice clean ship, motor good, fuselage cover new; wings good; black and silver; all necessary instruments. Lincoln Page: 3-place; total time ship and motor 13 hours; a beauty, blue and orange; one of the fastest OX jobs built. American Eagle, Model 201: Kinner K-5; one of the nicest flying ships ever built; steel prop, Bendix brakes, extra instruments; finish like new; orange wings, black fuselage, orange stripe. Blosser Motor Co., Concordia, Kansas.

J6-5 TRAVEL AIR B.E. 4000: Airwheels, rubbed finish, $1,200. J-5 Waco: special shock absorbers, tail wheel, semi-airwheels, extra motor, $1,250. Taylor Continental Cub; 14 months old; winter enclosure, $850. All three licensed to December. Wright-Bernard Airport, Youngstown, Ohio.

200 AIRPLANES: Crack-ups, motors, parachutes, OX-5 jobs $75 up. Complete directory with owner's price, name and address, 25¢, postpaid. A Practical Course in Acrobatics, fully illustrated, $1 complete, satisfaction guaranteed. Used Aircraft Directory, Box A-456, Athens, Ohio.

FOR SALE: Wasp-powered Speedwing Laird. 400 hours total time, generator, electric starter, navigation lights, turn and bank, NACA speed ring, black and gold; quick sale, $2,850. Mackey Flying Service, Findlay, Ohio.

CHALLENGER KR-31: OXX-6 motor; in fine condition; 27 hours since major overhaul. Never cracked always hangared. This is a bargain at $425. Newark Aero Club, Newark, New York.

FOR SALE: Challenger Robin, 3 hours since complete major overhaul on plane and engine; everything new. $1,200. Axelson Bird, many extras, $1,000. J-5 Travel Air, wonderful condition, $1,050. Hisso E Waco, new covering, brakes, $350. Oscar Meyer, Jr., Box 1059, Hendersonville, N. C.

AERONCA C-2: 395 hours; engine majored 300. Wings yellow; black scalloped leading edge; fuselage yellow, black. First $375 cash gets it. Municipal Airport, Knoxville, Tennessee.

J-5 TRAVEL AIR: Reconditioned, new covering, rubbed finish; motor majored, starter, steel propeller, new air wheels, brakes, racing windshields, licensed January, 1937. Sacrifice $1,150. Taylor Crossland, Mission, Texas.

FOR SALE: WACO A, Jacobs-powered; 20 hours since major overhaul; perfect condition; new tires, red and silver paint job. Frank Lumpkin, Jr., Columbus, Georgia.

LICENSED AMERICAN EAGLE: Model 101. Willis Morrow OX-5 engine; will license with Kinner engine. Dual controls; completely rebuilt and overhauled 30 hours back; new prop, Flightex covering; 9 coats Berryloid dope; hand-rubbed red and yellow fuselage, yellow wings. $550. Fritz Van Briesen, Sheldon, Iowa.

BEAUTIFUL STINSON: Special custom built, only one year old. Vermilion and Bonnett blue; highly polished, beautiful finish. Landing lights, position lights, flares, bank and turn, rate of climb, new RCA radio, wheel pants, buff leather upholstery. Total time 580, 180 since major. This ship is absolutely perfect in every respect; never made a hard landing. Sacrifice for $2,500, including extra engine and propeller. B. B. Soults, Pontiac City Airport, Pontiac, Michigan.

ENGINES: Majored by approved agency. Hornet B, $1,500; Hornet A-1, $750; Wasp S1D1, $2,500; Wasp C, $1,100; Wasp B, $800. J6-9-D, $1,250; J6-7-E, $1,250; J-5, $450. Lycoming 215 h.p., $595. Challenger 185 h.p., $400. Kinner K-5, $300. Babb, 1100 Airway, Glendale, California.

AERONCA C-3: Built August, 1934. Airplane and engine major overhauled July 15th this year. Only 80 hours since. Guaranteed as good as new, $1,095; $545 down. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

AMERICAN EAGLE: J6-5, 175 h.p. Wright, $1,100. Speed ring, compass, airspeed, brakes; licensed year from purchase. Trades or finance. Dick Schall (College Park Airport), Berwyn, Maryland.

BEECHCRAFT: Wright 420; demonstrator; 60 hours total time; cruises 202, tops 225; flares, lights, radio, all instruments, etc. Ship three months old and perfect. Big saving can be made. Write for details. Mouton & Six, San Francisco Airport, San Francisco, California.

1935 WRIGHT WHIRLWIND J6-7: 75 hours total certified time. Location: Wright factory, disassembled for inspection. Factory guarantee. A new engine at a large saving. AERO DIGEST, Box 2253.

BULL PUP: Motor just majored, ship just licensed, never cracked. George Loritz, care Boulevard Airport, Philadelphia, Pennsylvania.

AERONCA C-3: Built June 1935; ship in excellent condition; never cracked; best reasonable offer accepted; plane in New York area; write AERO DIGEST, Box 2259.

TANK ROBIN DE LUXE: Recovered, airwheels, steel prop; landing, position lights; other extras; $9[illegible]0. Or trade on Cirrus Fairchild 24, Rearwin, Kari-Keen, or similar ship. Lester Eddington, Hannah, North Dakota.

LICENSED AIRPLANES for sale or trade: Wright J6-5 Spartan, perfect condition, extras, $1,095. Tank Robin, new motor, recovered, $900. LeBlond 90 Swallow, completely rebuilt, majored, $675. Aeronca C-2, tripod gear, recovered last April, excellent condition, $350. Milwaukee Airways, Curtiss-Wright Airport, Milwaukee, Wisconsin.

NEW RYAN S-T: 125 hours; never been cracked; excellent condition. Full set of rear cockpit instruments; dual controls and navigation lights. Ready for immediate sale. H. P. Bingham, Jr., Manchester, Vermont.

DRIGGS SKYLARK: Gipsy-powered, de luxe model, less than year old; semi-airwheels, brakes, complete instruments. OX Eaglerock: Trade late light car and cash; 7 hours since majored. OX Overcashier cabin monoplane, 100 hours total time; very stable, licensed. Ivan Pownall, 317 N. Lafayette, Grand Rapids, Michigan.

FLEET, KINNER: Just majored, licensed, $1,500. Porterfield: LeBlond 70, only six months old, licensed, $1,200. American Eagle: OXX-6, just majored, licensed, $350. Curtiss Robin: OX; 3-place cabin, unlicensed. $250; license extra. Skycroft Airport, R.D. 3, Wilmington, Delaware. Hollyoak, 876-W.

CURTISS JR.: 257 hours; 6 hours since major. Licensed to December 1936. Good condition. $400, cash. Commercial Airport, Sales and Service, Coldwater, New York.

VELIE MONOCOUPE: 32-foot wing, split type landing gear, speed ring; recently majored, refinished; bank indicator, clock, duals; licensed September 1936; excellent condition, $550. Raymond Douglas, Devils Lake, North Dakota.

WACO 10, OXX-6: Red with silver wings; needs minor repairs; engine 75 hours since new, licensed to July. Best cash offer. Max F. Smith, Clearfield, Pennsylvania.

SACRIFICE NEW Fairchild "24", present series, flap equipped, to make way for 1936 model. Also splendid demonstrator, special finish, many extras. Almost brand new Lambert 90-A Monocoupe De Luxe; flaps, wheel pants; bargain. Texas Fairchild Sales Corporation, Municipal Airport, Houston, Texas.

AERONCAS: '33 and '34 models. E-113A motors. Guarantee no time since factory major. Enclosures, heaters, airwheels. Ships licensed and A-1 condition. $895 and $1,025. Can finance. "Al" Leeward, New Kensington, Pennsylvania.

"PIONEER" OFFERS for your convenience: The largest selection of used airplanes ever assembled. Terms arranged. Send stamp for list. Pioneer Aviation Company, Airport, Syracuse, New York.

BEST BUYS ON PAGE, less motors: B-5 6-place Ryan cabin ship, full airwheels, less motor, $850. B-1 5-place Ryan cabin ship, full airwheels, with or without J-5 motor, $550 less motor. J6-9 6-place Travel Air cabin ship, airwheels, excellent condition. One J6-7 250 h.p. Pitcairn, airwheels, loaded with instruments. These ships all NC licensed, and priced to sell, Michigan Aero Motors, Jackson, Michigan.

"PIONEER" OFFERS LICENSED Kinner-powered American Eagle, $800. Absolutely perfect; will take automobile as part payment, balance terms. Wire for preference. Pioneer Aviation, Airport, Syracuse, New York.

"PIONEER" OFFERS Speedwing J-5 Travel Air: Plane recovered, motor majored, speed ring, cockpit cover, snappy color, $1,250. Terms arranged. Wire for option. Pioneer Aviation, Airport, Syracuse, New York.

"PIONEER" OFFERS Lycoming Stinson SM8A model with "S" landing gear, airwheels, motor, fabric, finish excellent. $1,350. Terms arranged. Wire for preference. Pioneer Aviation, Airport, Syracuse, New York.

"PIONEER" OFFERS J-6 Buhl: 6-place cabin, 90% new; 140 m.p.h., airplane. Will take automobile or plane as part payment, balance terms. Pioneer Aviation, Airport, Syracuse, N. Y.

"PIONEER" OFFERS licensed Taylor Cub, $700; Aeronca, $750; Velie Monocoupe, $550; Monoprep, $500; Hisso Eagle, $450; OX-5 Waco, $395; Travel Air, $450. Wire Pioneer Aviation, Airport, Syracuse, New York.

"PIONEER" OFFERS licensed Challenger Robin, $1,000; J6-5 Stinson, $900; J-5 Stinson, $1,000; Waco F, $1,450; J6-5 Waco, $1,200; Reliant, 3,250; Beechcraft, $5,500. Pioneer Aviation, Airport, Syracuse, New York.

RECONDITIONED WACO 10: Fuselage recovered; wings and tail refinished; landing gear rebushed; motor major overhauled. Relicensed for year. Nelson Flying Service, Wyckoff, New Jersey.

$495; $250 DOWN for OX Swallow. Built 1933. 70 hours since new. Never cracked. Perfect condition. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON SM8A: Duals, navigation lights, S landing gear; 850 x 10 tires, Autofan brakes, $1,350 cash or will finance. Wolf Flying Service, Inc., Lock Haven, Pennsylvania.

FOR SALE: 1935 Aeronca, heater, brakes, compass, rear view mirror, color Loening yellow; 95 hours; $1,500. Muncie Aviation Corp., Muncie, Indiana.

BULL PUP: 164 hours since new; 16 hours since majored. Perfect throughout. $475. Trade for Waco, delivered. 1863 N. W. 25th Ave., Miami, Florida.

AERONCA C-3: Just recovered and majored. Always hangared. Navigation lights, new prop. For quick sale, $700, flyaway. E. Sanchez, 440 N. W. Second Avenue, Miami, Florida.

OX-5 WACO TEN: Rebuilt at the Ryan Aeronautical Co. No time since. Exceptional plane, rare bargain. Hangared in San Diego. Write Sam Deahl for particulars, Tallahassee, Florida.

SWALLOW OX-5: 3-place. For sale cheap or will trade for light car. Ship in good flying condition. Write Garden City Airport, Garden City, Kansas.

CLASSIFIED

CLOSING DATE

—April Issue—

MARCH 17th

FOR SALE: Lawrance motor, converted; two-throw crankshaft. Complete, good condition. Price $50, no trades. Propeller, $8. R. Hannum, Box 95, Downingtown, Pennsylvania.

HEATH V MONOPLANE with Harlequin 35 h.p. motor. Perfect condition; good performance. Sell or trade on 2-place ship. Box 222, Sterling, Colorado.

BELLANCA SKYROCKET: Wasp C; 220 hours since major; recovered 1935; new tires, radio, flares, speed ring, all blind flying instruments. Ship privately owned and its beautiful condition guaranteed. $5,750. Mouton & Six, San Francisco Airport, San Francisco, California.

FAIRCHILD CHALLENGER KR-31: OX-5; licensed, best of condition. Compass, duals, air speed, etc. Part interest. Thomas J. Conley, 7736 Oglesby Avenue, Chicago, Illinois.

KINNER BIRD: $975. Licensed to November. Plane recently refinished. Airwheels, K-5 motor; 150 hours since major. A real bargain. Donald Hood, Belmont Avenue, Northampton, Massachusetts.

TAYLOR CUB: 6 months old; 160 hours total. Enclosed; condition perfect, $1,025. Also Stinson S, 165 hours since majored; instruments, landing lights, flares, $1,850. C. M. Horstman, Box 451, Vero Beach, Florida.

FOR SALE: Lambert factory rebuilt engine; $325, no less. Wanted: Cirrus inverted pushing type, also Kinner K-5 with propeller and motor mount for Bird. Miki, 272 West Flagler Street, Miami, Florida.

OX ROBIN: Fabric in good shape, little time on ship and engine. Has steel prop, Scintilla, shock struts, semi-airwheels. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

WARNER 125 STINSON JR.: Excellent, $725. Velie Monocoupe, excellent, $450. Photos and details on request. United Flyers Co., Box 176, LaCrosse, Wisconsin.

SZEKELY BUHL PUP: $425; recent major; ship and motor like new. Never cracked. No trades. Richard Carson, 265 S. Second Street, Chambersburg, Penna.

AERONCA C-3: Just recovered and rebuilt. With or without factory overhauled motor and new prop. Special paint. Boulevard Airport, Philadelphia, Penna.

J-5 STINSON: $695; licensed, good condition throughout. Steel prop, duals, 5 hours since top overhauled. Beautiful six-place, real bargain. Giveaway at this price. AERO DIGEST, Box 22[illegible]0.

TRAVEL AIR S-600-B: $1,650. Fully equipped for night flying. Wright 330 engine, just topped. 140 hours since majored. Relicensed till October, 1936. Hirtz, 7604 Halsted, Chicago, Illinois.

REARWIN JR.: Latest Szekely; engine factory rebuilt July, 1935; plane recovered January, 1934; just refinished and relicensed. $575. V. E. Doan, 505 West Washington, South Bend, Indiana.

180 HISSO TRAVEL AIR: Good condition, licensed to February, 1937. Oil, water gauges, tachometer, altimeter, compass, brakes. Private use. $750. Robert Moffitt, South High, Muncie, Indiana.

J6-5 TRAVEL AIR: Being completely overhauled and recovered. Purchaser may choose color scheme. Total time 420. Including Irvin white silk chute, price, $1195. AERO DIGEST, Box 2261.

STINSONS: '34 and '35 models, like new; no time on motors; Smith propellers; many extras. 125 Kinner Bird, recovered, new motor. Kinner low wing. Aeronca and Taylor Cubs, almost new. Spartan biplanes. Fairchilds 22 and 24 models. E. W. Wiggins Airways, Inc., Providence, Rhode Island.

J-5 EAGLEROCK: Motor and plane A-1; will give full details by letter. Lombardo, 231 East 31st Street, New York, N. Y.

OXX-6 LINCOLN PAGE: $495. OXX-6 American Eagle, $600. Hisso Eaglerock, $700. OX-5 Millerized Robin, $7[illegible]0. J6-5 Robin, $1,250. De Luxe 4-place Challenger Robin, $1.350. Stinson Sm8A (ambulance attachment) $1,550. J6-7 Pitcairn, $1,750. Write for descriptive list. Sidles Airways Corporation, Union Airport, Lincoln, Nebraska.

FOR SALE: OX-5 American Eagle, licensed to August. A-1 shape, good cover, $350. Dan Lake, Lake City, Kansas.

TAYLOR CUB: Continental, new April '34, 325 hours total. Ship licensed, guaranteed like new. Motor just majored. Sell for best cash offer. Deliver or demonstrate anywhere for expenses. AERO DIGEST, Box 2262.

AMERICAN EAGLE: Kinner K-5 motor; fabric excellent, motor fair. $470 cash. Russell parachute and siren, $65. Wm. F. Meadows, 124 N. 40th Street, Louisville, Kentucky.

DE LUXE LATE GREAT LAKES: Completely overhauled, $1,150. Taylor Cub, special fuselage fairing, improved A-40-2, $750. Nearly complete parts for 6-place and SM7W Stinsons, $175. Jack Ray, Airport, Poughkeepsie, New York.

ENGINES FOR SALE: J-5, late series, majored, complete with 4000 Travel Air motor mount, oil tank, steel propeller. New Axelson B-7 with propeller. J6-5, with steel propeller. Kingsville Cabinet Shop, Kingsville, Missouri.

REAL BUY: J-5 220 h.p. Stinson, licensed, 6-place, steel propeller, Airwheels, brakes, air tail wheel, fabric excellent, licensed to September, 1936. Priced quick sale, $750, half cash, balance twelve months to responsible buyers. Michigan Aero Motors, Jackson, Michigan.

WACO CABIN: $2,300. Waco F, Warner, $1,275. Two Cubs, $850 and $600. Consider trades; can finance Cubs. Wire or write Clayton Lemon, P. O. Box 2144, Roanoke, Virginia.

OX-5 EAGLEROCK: Longwing, $275. Identified; 50 hours since major; new rings, pins, valves, guides. Refinished. Flying daily. Arthur Klingeman, 212 Bonnie Brae, N. E., Warren, Ohio.

GREAT LAKES 2T-1: Licensed January 1936; airwheels; wings and tail surfaces just recovered; excellent condition; price, $950. Waco 10 GXE: 75 hours since completely reconditioned; fuselage finished in hi-lustre blue, wings red; engine 90 hours since new; Flottorp prop; price, $475. Waco "A": Late 1933 Jacobs, no time since major; radio, bank and turn, Heywood starter, wheel pants, speed ring, yellow fuselage, green wings; excellent condition; price, $2,500. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

TRAVEL AIR SPORT 16-K: Kinner 125 h.p., excellent. $1,550; consider trade. 28 x 4 Bendix wheels, tires, tubes, brakes, $25. K-5 head cylinder complete, $30. Foster A. Lane, Port Columbus, Ohio.

LOENING AMPHIBION: 8-place spare Cyclone motor. Perfect condition, 50 hours since major overhaul, licensed, full sea equipment, electric starter, directional gyro. Reasonable. Spencer Laboratories, Akron, Ohio.

STINSON SM8A: Less than 400 hours total time. Best buy in Middle West. Privately owned. Relicensed until February 1937. Mel Meyers, 3301 Colerain Avenue, Cincinnati, Ohio.

CESSNA J-5: Fast and dependable. Good condition, recently overhauled and relicensed, refinished in attractive colors. Must sacrifice at $850. No trades. E. E. Foster, Draper, South Dakota.

15 CERTIFIED RECONDITIONED airplanes: Priced to sell. Two J6-9 Stinson six-place cabins; three J-5 Travel Airs; two J6-9 Straightwing Wacos; two Driggs Skylarks, Rover powered; OX Waco; three OX Travel Airs, two stressed for J-5 motors; OX Eaglerock model A-2; Heath, powered with Wright Morehouse. Sell any J-5 ship less motor. Trade in your ship or late model car. Terms if desirable. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

ENGINES AND PROPELLERS: 3 Wright J-5 engines, $325; Tank Aero Model 63 motor, $350; no time on above motors since overhaul. Steel propellers for J-6, J-5 and OX. Hamilton wood propellers while they last, $15. We also carry Flottorp and Bennett propellers for all motors. Write for details. Central Air Service, Inc., Grand Rapids, Michigan.

CLEARANCE SALE: Demonstrators and slightly used Cubs, some like new; can be financed. They won't last long; wire deposit to hold, subject to your inspection. Bennett Air Service Hightstown, N. J.

FOR SALE: Kinner Bird. Szekely SR-3-O complete. Set instruments. Buy or trade for speed ring, Heywood starter for K-5, pants for 22 x 10 x 4 tires. Gordon Gibson, Red Springs, North Carolina.

FOR SALE: Bull Pup, Szekely 45 h.p., compass, 14 gallon tank, wheel pants, new paint, new propeller, licensed, $400. Muncie Aviation Corp., Muncie, Indiana.

● WANTED TO BUY OR TRADE

WILL PAY CASH FOR Diesel aircraft engine, any make, size, shape or condition. Use for school purposes. State full particulars first letter. Manufacturers School, 1323-27 Race Street, Philadelphia, Pennsylvania.

CASH: For your airplanes, motors or parts in any condition. Want J-5, J-6 motors, propellers, air wheels and instruments. Write details in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

WANTED FOR CASH: 26-foot Switlik white silk seat pack. Also 24-foot chute. Must be perfect, priced right. George Peterson, Ginter, Clearfield Co., Pennsylvania.

WANTED: Will buy crashed, beyond repair or flying condition—Waco 9 and Hisso Waco. But must have A. B. 16. If you have the A. B. 16 for these ships, write AERO DIGEST, Box 2248.

WANTED: Cracked-up Savoia-Marchetti or Eastman Flying Boat. Give full particulars as to condition and price. Have late 1928 Buick sedan and cash. Raymond Nerad, 1321 St. Patrick St., Racine, Wisconsin.

SPOT CASH PAID for your airplanes, motors or parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WANTED: 650 x 10 Airwheel and propeller blade, DWg number 5B1-0. Or have same for sale. Kingsville Cabinet Shop, Kingsville, Missouri.

WILL TRADE: Raised deck cruiser, 32-foot. Location, New Jersey. For Cub or similar ship with duals. Or will pay $500. What have you? Ray Rider, Box 83, Salerno, Florida.

WANTED TO TRADE: New Chevrolet for late model small ship. Will pay cash difference if necessary. Want full description, photo. C. C. Giles, Clinton, South Carolina.

WANTED: OX-5 ROBIN. Also Waco 10 right lower wing and other parts. Dubuque Airways, Inc., Dubuque, Iowa.

WANTED: Wright J6-9 engines, any condition. Babb, 1100 Airway, Glendale, California.

WANTED: Four- or five-place amphibion in good condition. State date of license, manufacture, total time and lowest cash price. AERO DIGEST, Box 2255.

WANTED: Kinner Fleet, licensed and in good flying condition; reasonable for cash. AERO DIGEST, Box 2256.

WANTED: Aeronca C-2, in flying condition, or can use uncovered job if within reasonable distance. State hours, condition of plane, motor and license, and price. Must be reasonable, for cash. R. & P. Company, Box 821, Rapid City, South Dakota.

WANTED: Waco F or Kinner Bird or equivalent. Have Kinner A-15 Eaglerock in perfect condition, and cash. Steffen Aeronautical Service, Buffalo Airport, Buffalo, New York.

WILL TRADE: 1934 V-8 De Luxe sedan for NB-8, Inland or Hisso job. Must be good and a good deal. Bruce Gatton, 28 South Clinton, Iowa City, Iowa.

WANTED: 3 POLB with air-cooled motor. Give full details, lowest price first letter. Also wanted: 2 Government approved licensed parachutes. Canfield Flying Service, Williston, North Dakota.

$800 CASH AND 1935 Oldsmobile Six touring sedan; 12,000 miles; cost $1,045; fully equipped; like new; for three- or four-place open or cabin job. B. L. Hawks, Staunton, Virginia.

"PIONEER" OFFERS RELIABLE service to airplane buyers; if you want to sell, buy or have airplane financed, contact Pioneer Aviation, Airport, Syracuse, New York.

CASH PAID: For your airplane or parts in any condition. Want engines, parts, airwheels. State full particulars in first letter. Floyd Becker, Aberdeen Road, Grand Rapids, Michigan.

WANTED: Fleet and 5- or 6-place ship. Answer at once; leaving for New York soon. Johnny Jones, 1222 E. 58th Drive, Los Angeles, California.

WANTED FOR CASH: 2-place licensed plane. Prefer light air-cooled job, any make. Leonard F. Orndorff, 1448 Walnut Street, Zanesville, Ohio.

WANTED: Warner Fleet or Warner Waco F. Aymer Nelson, 2720 W. Michigan St., Duluth, Minnesota.

WANTED: Air-cooled two- or three-place plane, needing recovering or rebuilding. Crack-up considered. State exact condition and lowest cash price. Russell Byer, Willshire, Ohio.

WANTED: Used Edo No. 4650 floats with Travel Air 6000 struts. Must be cheap. Cash payment, or trade excellent pair Edo No. 3830 floats as part payment. Bert Hill, Round Hill Airport, South Dartmouth, Massachusetts.

WANTED FOR CASH: Good used Rearwin Jr. with Aeromarine motor. Crack-ups considered if priced right. Give full details first letter and lowest price. Allentown Aviation Corp., Allentown, Pa.

WANTED: One used licensed two- or three-place air-cooled ship for student work. Must be bargain, pay cash. Grady Montgomery, Shannon St., Jackson, Tennessee.

WANTED: J-5 Eaglerock, for cash. State price and particulars in first letter. Richard Behrens, 133 Lincoln Avenue, Mineola, L. I., New York.

WANTED AT ONCE: 10 airplanes for cash, regardless of condition. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

WANTED: Edo pontoons, type 4650, for use on the Travel Air 6000. Advise AERO DIGEST, Box 2268.

● MISCELLANEOUS SERVICES, OPPORTUNITIES, OFFERS, ETC.

ESTABLISHED AERIAL MAPPING and photographic company, outgrowth of large aeronautical corporation, desires partner with $20,000 for expansion and financing of large contracts. AERO DIGEST, Box 2242.

PILOT WISHES two partners to form a threesome to purchase, fly and maintain a used four-place Stinson cabin ship. Location, New Jersey. AERO DIGEST, Box 2243.

TRANSPORT COURSE, $1080; L. C. or Private, $290, flying new planes. Including training in business management, aviation sales, etc. Prices rise April 1st. Enroll now to save money. Free booklet. New Jersey's foremost flying school. Bennett Air Service, Hightstown, New Jersey.

WANT: Young man desiring training and experience for airplane mechanic's license. Must finance own living expenses. Give details first letter. AERO DIGEST, Box 2258.

PROPELLER BLADE rotating mechanism: Automatic variable pitch, twin engine drive; both engines operate, or interchange automatically from one to the other. This patent combines the only reliable automatic variable pitch, with the twin engine drive automatically interchangeable in flight; this is safety. See Patents No. 1,250,263, December 1917; 1,878,358, September 1932 and 1,887,053 November 1932. AERO DIGEST, Box 2246.

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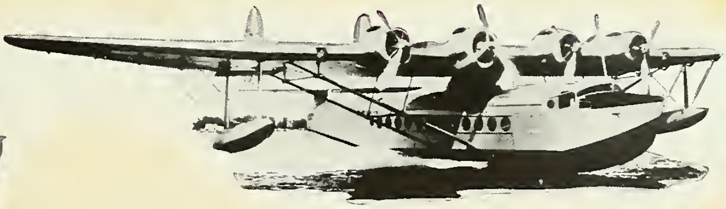

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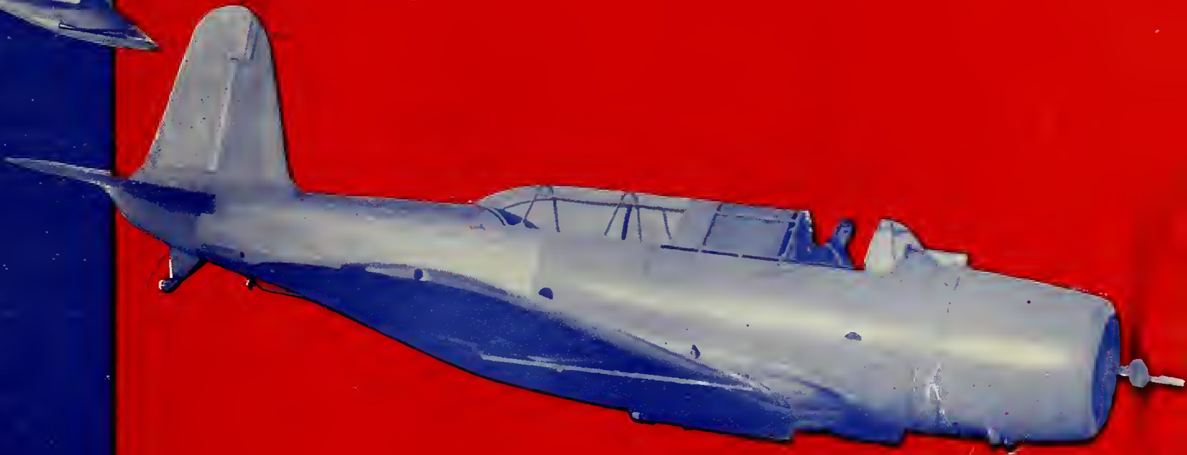

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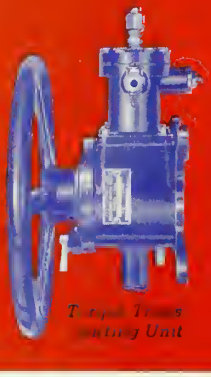
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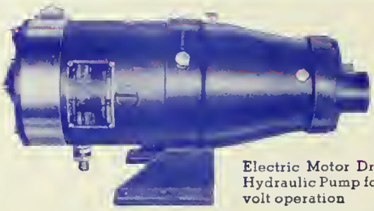
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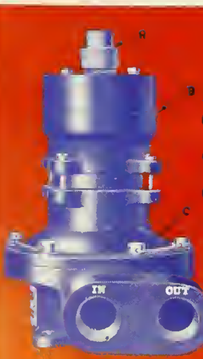

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(b) Transmitting Autosyn Motor

(c) Metering Assembly

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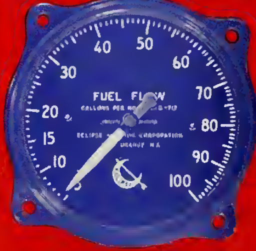

View of Flowmeter Indicating Dial

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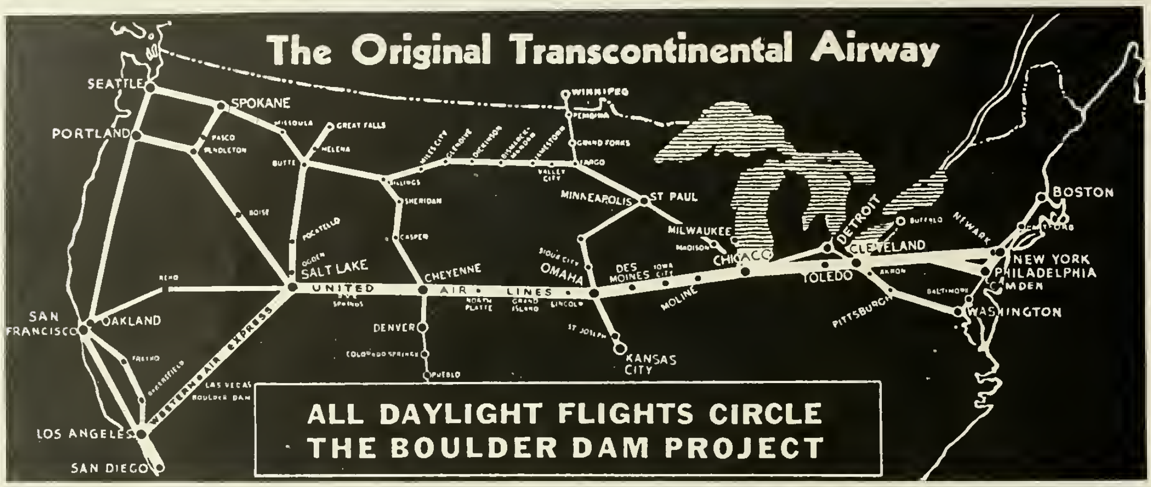

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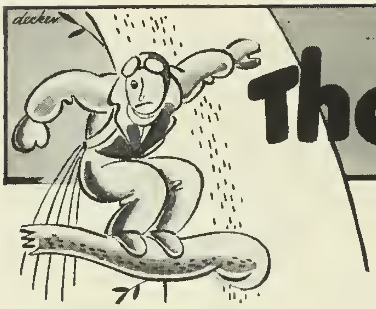
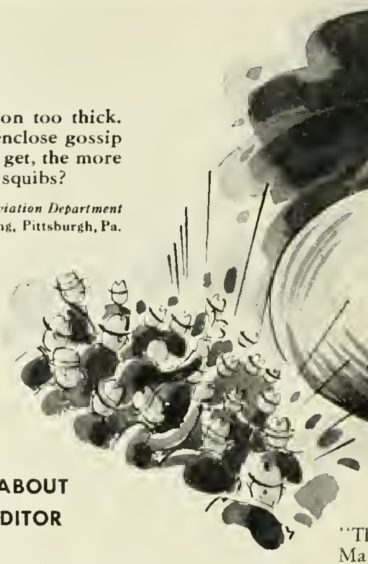
WESTERN BRANCH, 1224 Airway, Glendale, California **EUROPEAN DIRECTOR: Com. M. Calderara, 47, Av. de Brimont, Chatou (S. & O.) France**

The Birdmen's Perch



We're suckers for compliments—you can't lay it on too thick. But please, when you send us fan mail, won't you enclose gossip and yarns whenever you can? The more stories we get, the more interesting the "Perch" will be. How about some squibs?

MAJOR AL WILLIAMS, *Manager, Aviation Department*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.



NOT A YARN AFTER ALL

That yarn in the January "Perch" about the aviator who was thrown from his plane and the passenger who brought the ship down safely turns out to be true. We have a letter from the passenger.

Several years ago, Norman B. Curtice, now a resident of Minneapolis, took off from Norton Field, Columbus, Ohio, in a plane piloted by a friend, who planned to do some stunt flying.

Mr. Curtice, then knowing nothing about the operation of an airplane, was riding contentedly along enjoying the stunting when suddenly he noticed, not far below the plane, a man floating down with a parachute.

He turned hastily to call his friend's attention to the jumper and discovered that the plane was minus its pilot. The man with the parachute was none other than his friend, tossed out in some acrobatic maneuver.

Mr. Curtice, after a hectic period of experimenting with the controls, managed to bring the plane safely to earth.

FIVE TRIPS TO THE MOON

From August, 1934, to the end of December, 1935, planes of the Pennsylvania Air Lines flew approximately 1,250,000 miles on Gulf Aviation Gasoline, more than five times the distance from the earth to the moon. A good distance, a good airline, a good gas—say we.

ONE ABOUT THE EDITOR

"Major Al Williams—Dear Percher:

The last time I saw you in action you were testing a new Pursuit ship. Everything was going along fine until you tried to sit down. You overshot your field and seemed to be getting nowhere fast.

"The fun began when your new winged comet caught fire. How well I remember the sigh of relief that went up on the field when you finally got down.

"You probably don't remember who was the first bearer of a fire extinguisher to reach your side. Well, I was it.

"My old Pitcairn Mail-wing is as old as Methuselah's great-grandmother, but one of these days I'll put a pint of Gulf gas and oil in her tummy and pop up to see you in Pittsburgh." —C. A. C.

THIS MONTH'S WHOPPER

"They call me Dizzy Van, the Motorcycle Man. Four years ago I was a famous daredevil. Now I don't have enough nerve to walk across the street.

"My act was a thriller. I started my motorcycle circling around the bottom of a 40-foot wooden bowl. As I gained speed I would spiral to the top, then cut down the motor and return.

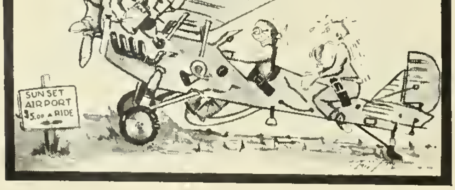
"One night a friend got me to try Gulf Aviation Gas in my machine.

"As soon as I started I knew I'd done the wrong thing. I whirled to the top in half the usual time but when I tried to slow the darn thing down, it was no soap.

"The motorcycle circled so fast that I had hard work holding it in the bowl at all. My brakes shot up in smoke. And there was I, whirling around like a fly on a phonograph record. I kept going for days.

"Finally the gas gave out and I sank to the bottom of the arena—more a merry-go-round than a man.

"Since that time I am only happy when I spend my days in a revolving door and my nights sleeping in a barrel." —V. H.


SHE OUGHT TO HAVE PLENTY PEP NOW JUST NEEDED SOME GULF PRIDE MOTOR OIL
SUN SET AIRPORT $5.00 A RIDE

YOUNG CARTOONIST

The cartoon in the lower left hand corner of the page was sent in to us by Paul E. Tuttle, East Orange, N. J. The artist writes: "I am 23. Attended the Museum School of Fine Arts in Boston. Aspired to become a cartoonist, and don't mind telling you that your letter of appreciation was a Godsend."

Gulf Oil Corporation of Pennsylvania
...Gulf Refining Company...makers of

GULF

GULF AVIATION PRODUCTS

YOU CAN WIN IN AVIATION

This view of the Wood Working Department at Parks Air College is indicative of the completeness of equipment provided for training in all departments of Mechanics, as well as in the Piloting, Engineering and Executive Schools. In these Schools a quarter thousand students, representing 41 states and 10 foreign countries, are preparing to carry on the development of commercial aviation.

●

Summer Term Starts July 6

●

Fall Term Starts September 28

●

You have been watching the unfolding miracle of air transportation, from its uncertain beginning ten years ago, to the present day. You have seen planes develop from the cumbersome DeHavilands, carried over from the World War, to today's efficient transports which combine three-mile-a-minute speed with living-room comfort, security and economy.

In the past ten years, you have seen air transport shrink the United States to an area the size of Pennsylvania, when measured in time required to travel across it. You have seen the mighty Pacific conquered by the Clipper ships which make regular scheduled crossings that bring Manila to within seven days of New York.

And yet, authorities say, and doubtless you agree with them, only the beginning of commercial air transport has been seen. Already 40-passenger land transports, nearly twice as large as the biggest of today, are being built—already United States and England are cooperating to start, this Summer, North Atlantic crossings, and one-hundred-thousand-pound flying boats are being built for the service. They will span the 3,337 miles between New York and London in 22 hours.

Already round-the-World schedules are planned which will take the traveler from New York, around the Globe and back to New York in 14 days.

What the future holds none can say, but you can be sure that the on-rush of aviation's development will continue.

WHAT DOES THIS MEAN TO *YOU?*

You know it means opportunity, advancement, travel, achievement, for hundreds and thousands of men. Will you be one of them?

You can be, if only you do your part. You must acquire an accurate technical knowledge of aviation, together with the skill necessary to use it, so that you can help in the development of aviation. You must secure adequate training that will enable you to meet the high requirements of aviation.

Parks Air College offers you such training. In all parts of the World its graduates are serving aviation as mechanics, foremen, factory managers, meteorologists, radio operators, flight mechanics, second flight officers, first flight officers, and division superintendents.

The training which meant boundless opportunity for these men is available to you. With it you, too, can WIN in aviation.

SEND FOR THE FREE CATALOG

Your first step is to learn about the training offered by Parks Air College. It is contained in the catalog and bulletin. These books are free. The coupon will bring them promptly. Fill out and mail it now.

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

Accredited by the Illinois Superintendent of Public Instruction.

PARKS AIR COLLEGE
WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 5AD

EAST ST. LOUIS, ILL.

Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name____________________Age______

Address ____________________

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CHECK HERE
for special information on the course that interests you:

- ☐ Executive Transport Pilots'
- ☐ Aeronautical Engineering
- ☐ Master Mechanics' Flight
- ☐ Executive Course

Why—
FEED SO MANY HORSES?

CESSNA AIRCRAFT COMPANY » » Wichita, Kansas

PROGRESS

This month marks the tenth anniversary of the beginning of scheduled airline transportation in the United States. Six years previously, Pioneer had started the development of many of the instruments which have since been a part of the equipment of every plane flown on the airlines.

Pioneer has always kept ahead of the needs of air transportation, developing new instruments and improving existing types to meet the requirements of increased performance of aircraft and the demand for safe operation under adverse conditions.

An important factor in Pioneer's leadership is the experience gained in sixteen years of research and manufacture.

PIONEER INSTRUMENTS

PIONEER INSTRUMENT COMPANY, INC. • 754 LEXINGTON AVENUE • BROOKLYN, N. Y.
A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

COMPARE IT!

The Ryan S-T has created a new class of airplane so far superior to the conventional type in construction, beauty and performance that it acknowledges no competition — here are the facts!

for DESIGN

To gain its remarkable performance and efficiency, the S-T utilizes the latest proven developments in design and construction, previously available only in the most modern high speed transports. All metal monocoque fuselage, and scientific streamlining that is as graceful as it is efficient, are incorporated in a basic design of exceptionally high structural safety factors and one that also permits unparalleled vision from either cockpit.

for PERFORMANCE

The S-T cruises at 125 m.p.h. . . . climbs 1200 f.p.m. and offers pursuit plane maneuverability. It is one of the easiest planes to fly . . . in training or for sport. Both trimming tabs for easy, accurate elevator adjustment and wing flaps for slow, steep approaches are provided.

for ECONOMY

With its 17 miles per gallon of gasoline, its long lived, efficient Menasco engine, and its trouble-free metal construction, the S-T offers unusual economy of operation.

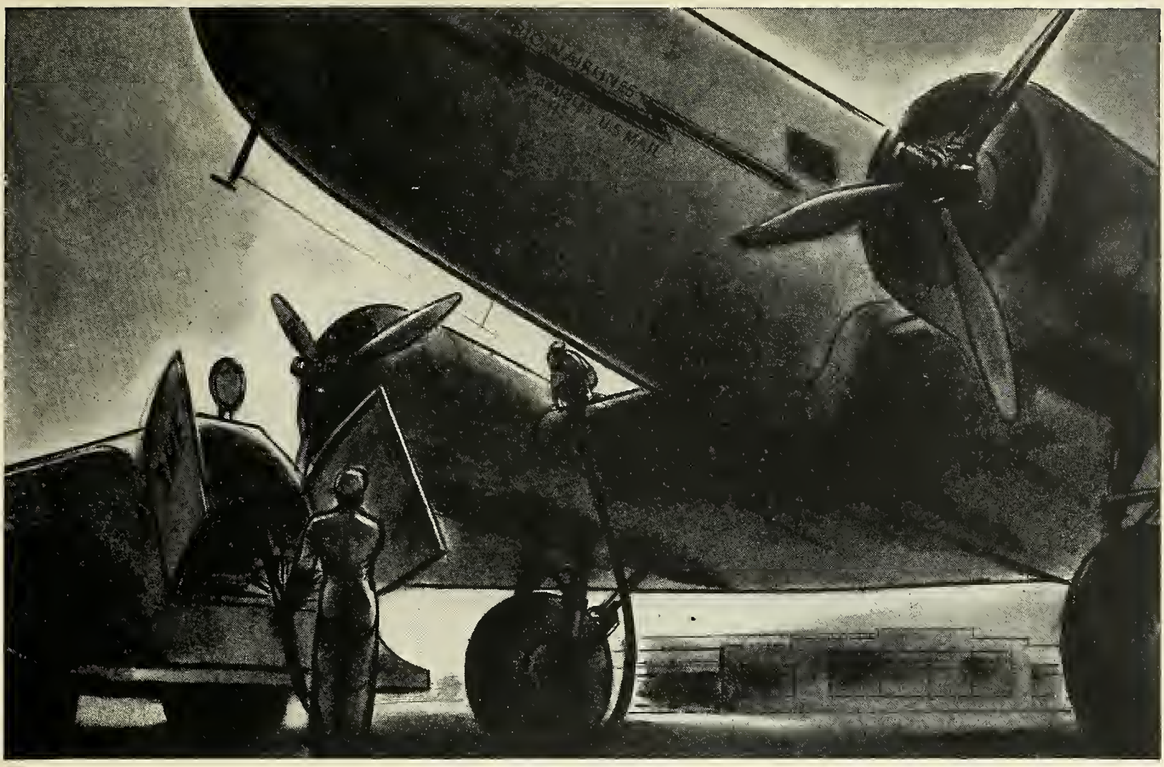
for PRICE

The recent reduction in price of both the 95 h.p. and 125 h.p. Menasco-powered models S-T further widens the gap between this outstanding airplane and others. Today you can purchase for immediate delivery the new Ryan S-T fully equipped, including wheel pants, wing flaps and other "extras" totaling some $700—for as low as $3985. If you desire, the new Ryan can be purchased out of income. Write for literature.

RYAN AERONAUTICAL CO.
LINDBERGH FIELD ✈ SAN DIEGO, CALIFORNIA

A few valuable dealer territories are still open, offering exceptional business opportunities to qualified firms

RYAN
S·T



For the new DOUGLAS

. . . a balanced gasoline

The gasoline for the new Douglas had to give: 1. Utter dependability! 2. 219-mile-an-hour cruising speed! 3. Quick starting—even at 20° below zero! 4. Reserve power—and plenty of it! 5. Economy of operation—resulting in low travel rates. (The two Wright Cyclones eat up 90 gallons an hour!)

NO one quality could be developed at the expense of another. It was a clear case for an all-around aviation gasoline—a "balanced" gasoline. And Shell produced it!

Today, Shell supplies a "balanced" gasoline for any type of aircraft . . . with octane ratings from 73 up to the newly-announced "100."

You can get Shell Aviation Gasoline at most airports throughout the country.

For further information write The Aviation Department, of the Shell Oil Company, San Francisco, the Shell Petroleum Corporation, St. Louis, or the Shell Eastern Petroleum Products, Inc., New York.

SHELL

AVIATION GASOLINE

Dallas Aviation School and Air College

LOVE FIELD *A Government Approved School — Established 1926* DALLAS, TEXAS

WHAT YOU SHOULD HAVE

Among The
Many Advantages
IN DALLAS
For Aviation Students

1. Best flying conditions in U. S.
2. More open flying days than elsewhere.
3. Less flying hazards.
4. Commercial aviation at its best.
5. All school operations at Love Field.
6. Love Field one of nation's finest airports.
7. A Government approved school.
8. 55,000 square feet of space for school purpose.
9. 12 fine airplanes for student use.
10. Complete shops and class rooms.
11. Board and room at the school.
12. Every student a guest.
13. Part time work with all courses if desired.
14. Free transportation allowance.

Everything You Want YOUR School To Be
THIS SCHOOL IS!

The student pilot or student mechanic who comes to Dallas finds the best of everything—complete equipment, long experience, all-season flying weather. LIBERAL TREATMENT of every student, THOROUGH TRAINING in every department. Our boys like it here.

This Is Your Special "Invite"

to write for our new illustrated 60-page catalog and Special Centennial Price List. Send for it—see how much MORE this school has to offer you.

Our TEXAS CENTENNIAL Enrollment

offer is now in effect. The savings are well worth your while. The Texas Centennial (opening June 6th) is the most stupendous undertaking ever launched by an American city. Buildings and grounds cost OVER EIGHT MILLION DOLLARS. Exhibits from all over the world. Our boys will be right there!

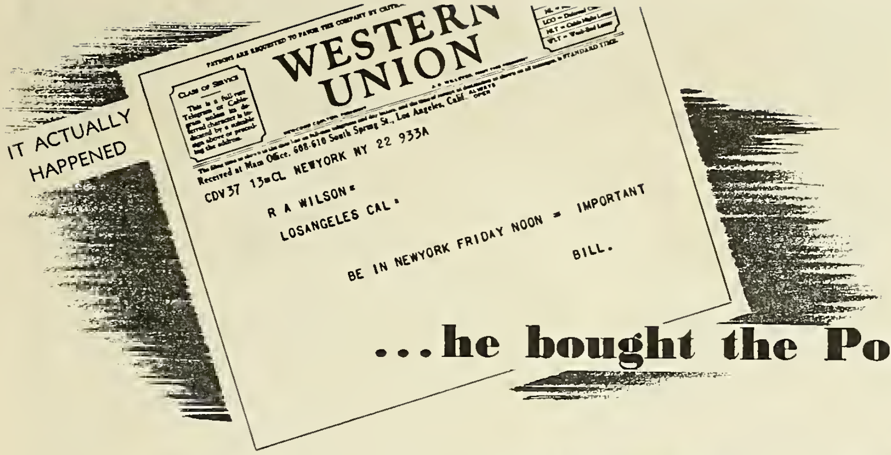
THE PRESIDENT OF THE UNITED STATES
will be in Dallas on June 6, for the opening of the Centennial. You will see famous people from all over the world in Dallas and at Love Field.

You Can't
BUY More
why
PAY More?

More Pilots (Army and Civilian) learn to fly in Texas than anywhere else in the U. S.

Write for our catalog. Address

**DALLAS AVIATION SCHOOL
AND AIR COLLEGE . . . .
Love Field - - - - Dallas, Texas**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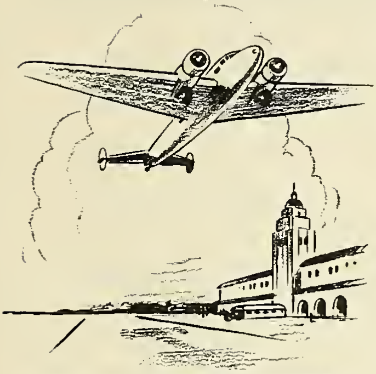
LOSANGELES CAL=

BE IN NEWYORK FRIDAY NOON = IMPORTANT

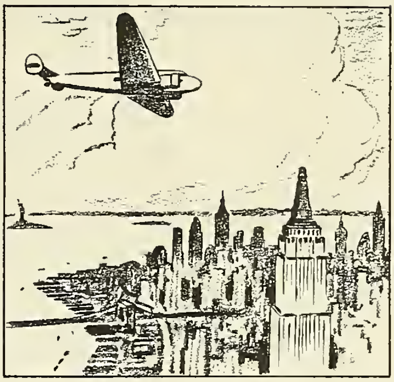
BILL.

...he bought the Ponies, too

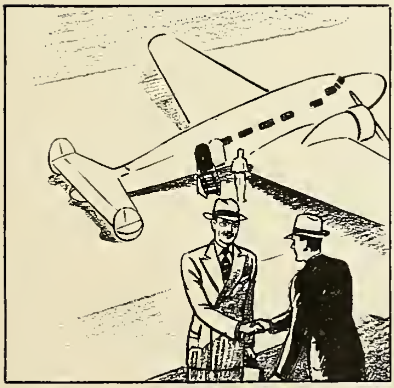


THURSDAY—LOS ANGELES
R. A. Wilson, Los Angeles business man, on urgent call, is en route to New York in his bi-motored Lockheed.

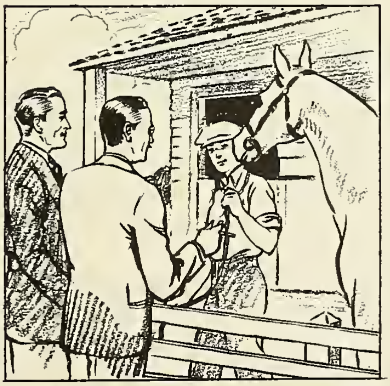
THURSDAY NIGHT—CHICAGO
Stays overnight with friends in Chicago.



FRIDAY—NEW YORK
Arrives in New York by noon and conducts business in the afternoon and evening.



SATURDAY—DALLAS
Heading west again, Wilson gets together with an old college friend in Dallas who advises him of a string of polo ponies available at nominal price.

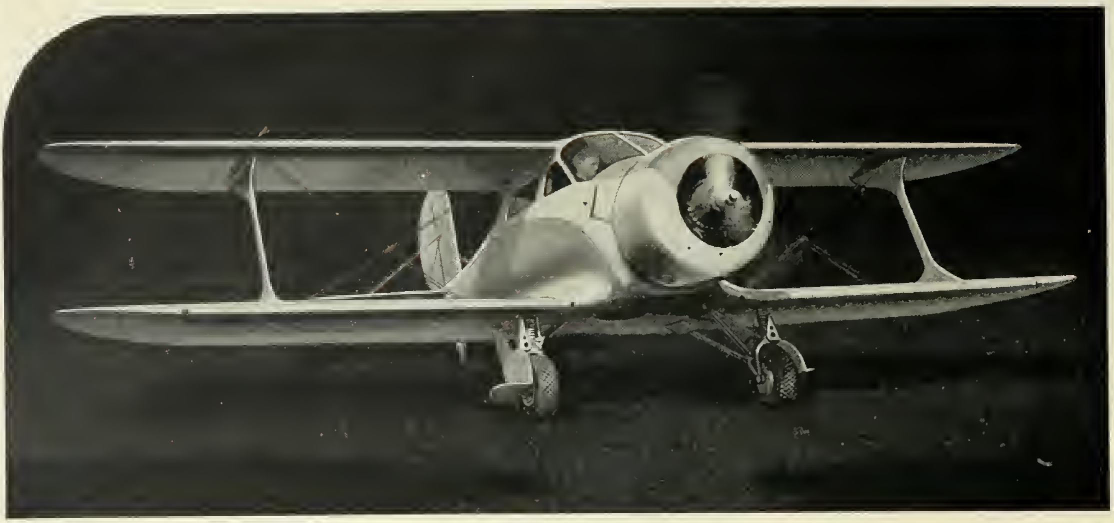


SATURDAY NIGHT—LAREDO
Both fly to Laredo where they inspect the ponies. Friend stays over to close the deal and Wilson continues homeward next day by "Off Airline" route.

MONDAY—LOS ANGELES
With his Lockheed, Wilson has been able to fly his own route and schedule without inconvenience or wasted time and is back home Sunday night, ready for business Monday morning.

LOCKHEED AIRCRAFT CORP ◆ BURBANK ◆ CALIFORNIA

New York Office—614 Chrysler Building • Chicago Office—2353 Field Building • Dallas Office—Hangar No. 4, Love Field



. . SELLING 100% FASTER

Beechcraft's sales for the first three months of this year were 100% ahead of the sales for the same period last year.

True, Beechcraft has been consistently improved, but steady improvement alone does not explain such a sensational sales record.

This 100% increase is the result of a fast growing confidence in the claims we make for Beechcraft performance. Owners have learned from experience that Beechcraft advertising *leans far on the conservative side.*

REMEMBER THIS WHEN YOU BUY AN AIRPLANE.

Model C17 Special

Here is a new Beechcraft Special at a low price.

A few valuable sales territories are still open for Beechcraft representatives.

Just Off The Press

The New Beechcraft Catalog includes specifications and description of Models C17L, C17B and C17R. Write for your copy.

It will CRUISE AT 161 M. P. H. at 7200 feet . . . . land at 45 m.p.h. . . . . is licensed for four passengers in addition to the pilot . . . . cabin is roomy and beautifully appointed . . . . large luggage compartment. It also offers the safety of fully rectractable landing gear. *No extra equipment is necessary!*

Model C17 Special puts Beechcraft, for the first time, in the price range with *slow speed* airplanes. Now you can have the advantages of Beechcraft's *greater economy, faster speed, extra comfort and extra safety at no extra cost!*

IT ACTUALLY COSTS LESS TO OWN AND FLY A BEECHCRAFT.

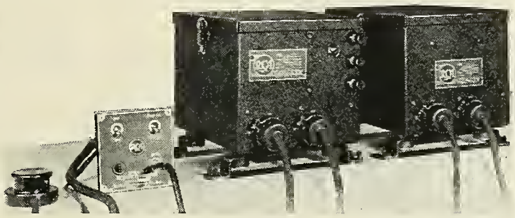
$7495.00

at The Beech Aircraft Company,
Wichita, Kansas

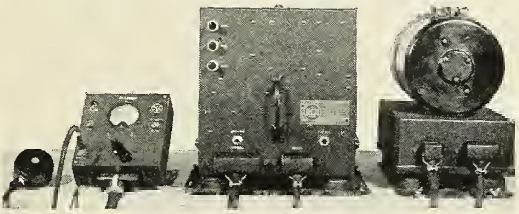
BEECHCRAFT

WHEN you're flying across country and weather conditions suddenly change—then's when it means a lot to call for a weather report from the nearest airport, and get it immediately. It is for service such as this that RCA has developed two new aircraft transmitters.

But these new instruments feature reliability, ruggedness, lightweight, low prices, and high RCA quality. Both were developed by RCA radio engineers in collaboration with pilots, and were tried, tested and proved in RCA's own planes. Not until they had passed every technical and practical test were they released for production. See these new transmitters, or write for details.



RCA Model AVT-7 and 7A Aircraft Transmitters Offer communication by 100% modulated radio telephony, or CW telegraph. Power, 10 watts. AVT-7 has a vibrator power unit and weighs 28 pounds net; AVT-7A, a dynamotor power unit, weighs 26½ pounds. Both operate from standard 12-volt battery. Phone or CW on either of two pre-determined frequencies instantly selected in flight by flipping a switch. Crystal control.



RCA Model AVT-12 and 12A. Basically like the AVT-7 and 7A but with higher power, hence longer range. AVT-12 offers 50 watts on phone, 75 on CW; AVT-12A, 30 watts on phone, 45 on CW. Weights 69 and 57 pounds net, respectively. Both use dynamotor power supply. Three pre-determined frequencies. Crystal control.

• • •

RCA Radio Compass COMING!

Remarkable new radio compass especially developed by RCA for aircraft will shortly be ready. You'll be amazed by its high quality and low price. Watch for announcement.

AIR ASSOCIATES, INC., Glendale, California; Chicago, Illinois; Garden City, L. I.

AVIATION RADIO SECTION

RCA MANUFACTURING CO., INC., Camden, N. J., a Service of the

RADIO CORPORATION OF AMERICA

The Great Silver Fleet, Eastern Air Lines' outstanding service that radiates from New York, Chicago, Florida and the South to Washington . . . is Douglas equipped. This is character service—the logical safeguard to the Nation's leaders of business and state.

Because more airlines today use Douglas equipment than have ever standardized on one airplane before, the security . . . luxury . . . and speed of these modern Douglas Transports has become the measure by which the world now reckons air transportation. ✈ Douglas Aircraft Company, Inc., Santa Monica, California.

WHEREVER YOU GO . . .
TRAVEL VIA LUXURIOUS DOUGLAS EQUIPMENT

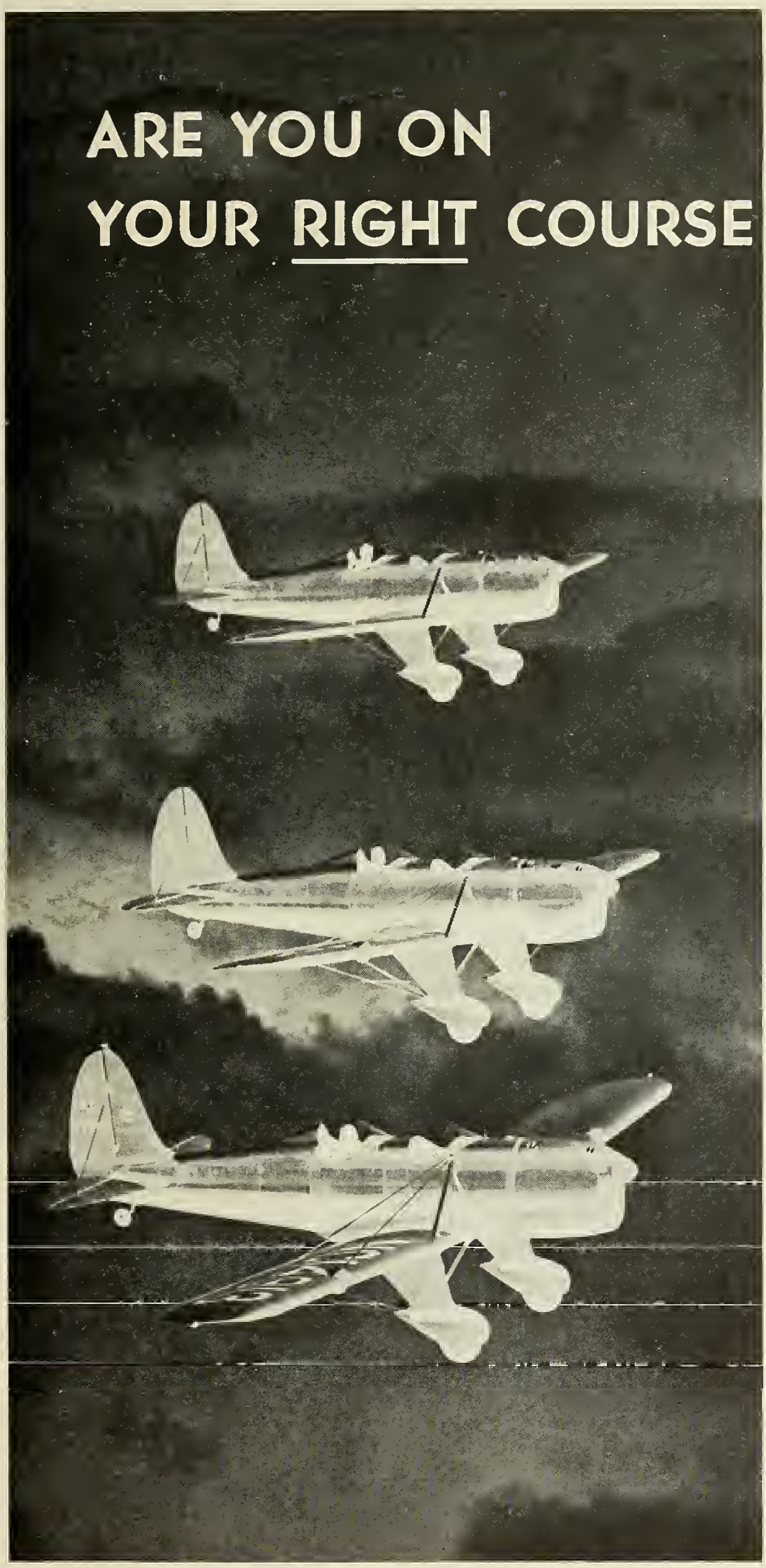
In **AMERICA** . . . on American Airlines, Inc. . . . Eastern Airlines . . . Pan American Airways . . . T.W.A., Inc., and Wilmington-Catalina Airline, Ltd.

In **THE ORIENT** . . . on Japan Air Transport, China National Aviation Corporation, and K.N.I.L.M. in the Netherlands Indies.

In **SOUTH AMERICA** . . . on Pan American Grace Airways.

In **EUROPE** . . . OELAG in Austria; Deutsche Lufthansa in Germany; K. L. M. in the Netherlands; L.A.P.E. in Spain; LOT in Poland; C.L.S. in Czechoslovakia; Avio Linee Italiane in Italy; and Swissair in Switzerland.

ARE YOU ON YOUR RIGHT COURSE?



Actual photograph of Ryan S-T's in formation flight practice over Ryan School of Aeronautics

FOR a few dollars, perhaps, you can go through the motions and actually get off the ground. But what about your future? What about the additional safety and commercial possibilities that a full knowledge of aviation will open to you?

During the 14 years of experience, RYAN has started many ambitious young men and women flying the RIGHT course, and has developed a superior type of complete training that will help you. There is no finer equipment available anywhere—nor such perfect flying weather as here in sunny San Diego. Here, the Ryan School has established an international standard of thoroughness—backed by more experience and greater advantages of a climatic, commercial and military *aeronautical* nature than you can obtain *in any other city.*

For those who want maximum training and experience at comparative lowest cost—for those who anticipate the eventual purchase of a plane for sport or commercial purposes — the RYAN DE-LUXE COMBINATION plan of complete government approved transport training plus the ownership of a new Ryan S-T plane is unsurpassed. This unusual course gives complete instruction for the highest government pilots' license—enables the student to acquire hundreds of hours of additional flying experience, which is so necessary a background for the best flying positions — and actually saves the student approximately $1400. The combination plan can include either the Ryan S-T 95 h.p. model or the Ryan S-T-A 125 h.p. model* at the same saving in cost.

Consider these facts when you plan your course. Check the coupon below for the graphic story of why Ryan offers you greater advantages in your plans for the future.

* The standard S-T-A model is the one used by Tex Rankin at the December Miami Air Races where he won first place in the 550 cu. in. speed event, won the aerobatic trophy and, for planes in this classification, established a new unofficial world's altitude record of 20,000 ft.

RYAN SCHOOL OF AERONAUTICS

LINDBERGH FIELD, SAN DIEGO, CALIF.

RYAN SCHOOL OF AERONAUTICS
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I am interested in courses checked; Please send additional information

☐ Transport
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☐ Ryan deluxe Combination Course Transport training plus new Ryan S-T high performance plane.

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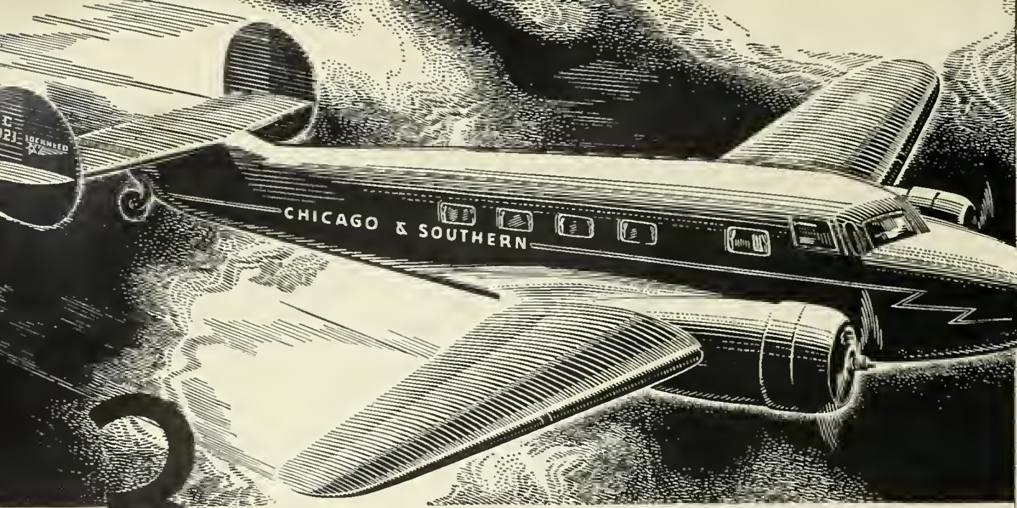

3 HOURS *Faster*

CHICAGO *to* NEW ORLEANS

via WHIRLWIND *Powered* LOCKHEED ELECTRA TRANSPORTS

Wright Whirlwind 450 h.p. Engines power the fleet of new, all-metal, twin-engine Lockheed Electra Transports placed in service May 1, 1936, on Chicago and Southern Air Lines.

Cruising at 180 m.p.h., the swift, Whirlwind-powered Electras have clipped three hours' flying time from Chicago to New Orleans—and cut time proportionately to all intermediate points along "The Valley Level Route."

Chicago and Southern Air Lines is the third air transport operator to install fleets of Wright Whirlwind-powered Lockheed Electras during the past year. High-speed transports of this type are also in operation on Eastern Air Lines and Delta Air Lines.

The new 450 h.p. Whirlwinds are twice as powerful as the Whirlwind which powered Colonel Lindbergh's famous flight from New York to Paris in May, 1927. Since that memorable flight, Wright Whirlwinds and Cyclones have provided dependable, economical power for hundreds of millions of miles of passenger and air mail transportation.

Wright Cyclone and Whirlwind Engines are now standard power equipment on leading airlines of the United States and throughout the world.

CHICAGO & SOUTHERN AIR LINES

NEW SCHEDULES

South Bound

Lv. Chicago	Ar. New Orleans
9:15 A.M.	4:35 P.M.
5:30 P.M.	12:15 A.M.

North Bound

Lv. New Orleans	Ar. Chicago
9:05 A.M.	3:40 P.M.
5:00 P.M.	11:59 P.M.

WRIGHT
AERONAUTICAL CORPORATION
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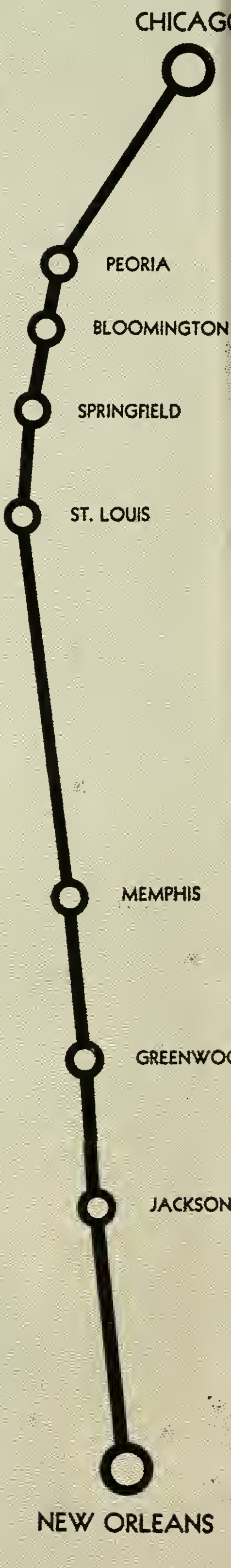
CHICAGO &
SOUTHERN
AIR LINES



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VOLUME TWENTY-EIGHT NUMBER FIVE

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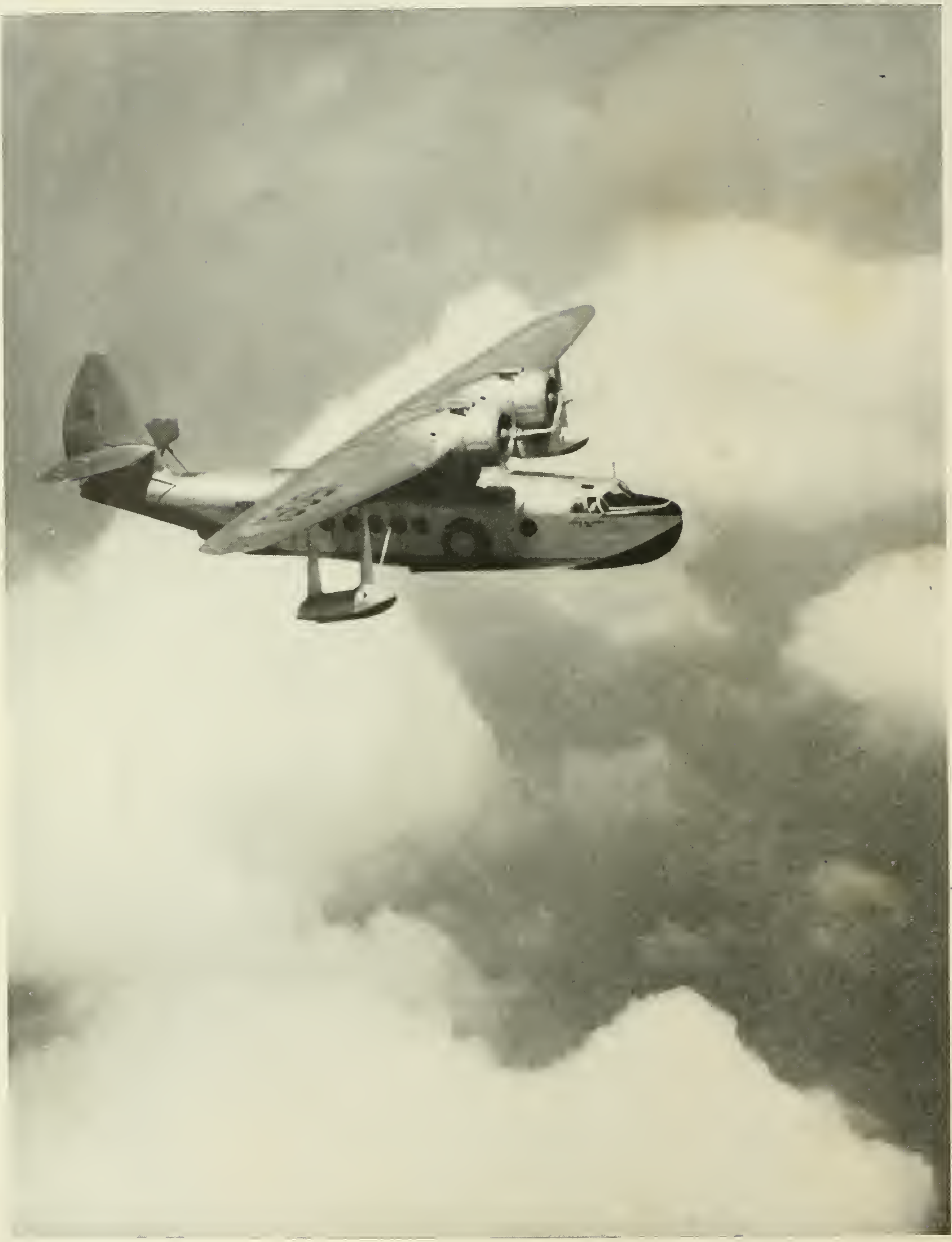


Flown by Capt. Boris Sergievsky, with Igor Sikorsky as observer and accompanied by a mechanic, the Sikorsky S-43 broke two altitude records last month. Previous world's records were 18,641 ft. for Class C-3 amphibions without load, and 17,877 ft. with a payload of 1102 lbs. The S-43 reached an indicated altitude of 27,950 ft. with its 1102-lb. load.

AIR
HOT AND OTHERWISE

By FRANK A. TICHENOR

● Stop this foul business of playing politics with human lives! Stop the Department of Commerce from continuing this heinous crime of covering its own tracks when it shares the blame for a major airline crash. The safety of airline travel, the future of a great industry, the lifeblood of passengers demand it.

We have implied before on this page that the Bureau of Air Commerce was not playing altogether square in its investigation of and reports upon aviation accidents. Here is substantiating evidence. It is the report of Charles H. Payne, who, at the request of Colonel Harold E. Hartney, made a special investigation of the T.W.A. crash in which Senator Cutting was killed. This report has been confirmed by Senator Royal Copeland, chairman of the Senate committee investigating airline safety. Recall what the Bureau of Commerce said in its report on the same accident. Recall how it charged T.W.A. with negligence, how it damned the line for violations of air commerce regulations. Then read the following excerpts from Mr. Payne's report and judge for yourself who should be damned:

"My conclusions are substantiated by affidavits obtained on my trip and by review of affidavits obtained by the Investigating Committee some months ago, and also by testimony given by various individuals before the Committee, and by personal check-up. They are as follows:

"I attribute the accident to the following causes:

"(I). *The breaking of the radio beam by the Department of Commerce operator at Kansas City.*

"At 1:45 A.M. on the morning of May 6, 1935, Ted Haueter, Assistant Dispatcher of T.W.A. had his clerk, Mr. Marmaduke Hillias telephone the Department of Commerce at Kansas City and ask for continuous beam, because Flight 8 (one-half hour ahead of Flight 6) was then approaching Kansas City. The weather at the time was growing worse and, as a result, Flight 8 needed the continuous beam to land. As Pilot Graves of Flight 8 was approaching the field at about two o'clock, the beam was suddenly cut by the Department in order to broadcast weather. This took away from Pilot Graves the only guide by which he could safely land his passengers at Kansas City and made it necessary for him to pull up in the clouds and make another attempt after the beam was reestablished.

"Mr. Mulligan of the Department of Commerce estimated the time thus lost at 25 minutes and this, according to his own statement, was 'a fatal delay.' Due to Graves' delay in landing, the dispatcher ordered Bolton, Pilot of Flight 6, who was 30 minutes behind Graves, to hold off until Graves landed.

"I believe that had not the Department of Commerce broken the beam and delayed Pilot Graves, Pilot Bolton would have been able to come to Kansas City and landed his passengers safely.

"It is to be noted, that even with the delay, Bolton could possibly have landed his passengers safely, in Kansas City, except for the minimum ceiling rules, as prescribed by the Department of Commerce for landing at Kansas City, and beyond question of doubt, Bolton would have done this, in spite of the regulations, except for the fact that Mr. C. Homer Jones, Department Keeper at Millard Field (Kirksville, Mo.), was giving incorrect weather reports. Had Mr. Jones reported weather conditions as actually existed at Kirksville, the plane would not have been dispatched to that point.

"(II). *Erroneous weather reports from Kirksville by C. Homer Jones of the Department of Commerce.*

"I am firmly convinced after not only reviewing all the affidavits from citizens in and around the Millard Airport, but also discussing conditions with them, that the weather forecasting given by Mr. Jones was erroneous.

"According to Mr. Mulligan there was a 'wall of weather' at the scene of the accident. I have been unable to find any weather man or meteorologist who can define this expression. After reading Mr. Jones' testimony and cross-examination, I have no confidence in his weather reports or his statements, for the following reasons: 1. That he stated he had no visitors between midnight and early morning. (Note:—Mr. Hollis Saffel states he was with Jones from 12:30 to 1:45 A.M.—Editor.) 2. Mr. Jones stated in his questioning by the Senate Committee that at no time had he walked out on the field with Colonel Hartney and pointed out the visibility markers. (Affidavits of Mr. Ray H. Lyons and Colonel James E. Riegar are to the effect that they both saw Mr. Jones and Colonel Hartney walk out on the field and point in various directions.) 3. He stated that all people making affidavits had made misstatements. 4. That his personal friends never visited him at the field.

"(III). *The defective radio beam from Kansas City, which misled Pilot Bolton to a point 16 miles south of the Kirksville Field and so far away that he could not see the beacon lights or pick up the weak radio beacon signals originating from KCC-12.*

"Mr. Mulligan repeatedly states in his testimony before the Committee that he could not account for Bolton being 16 miles south of the Kirksville Field.

"All of the testimony shows that Bolton's ship was first seen or heard 18 miles or more south of the field and that he had flown 2 miles north before the accident.

"In view of the weather, admittedly prevailing between Kansas City and Kirksville, Bolton undoubtedly was flying on instruments and had followed the Kansas City beam. Therefore, his position definitely suggests that the Kansas City beam was off course.

"J. A. Mount in his testimony says: "'The radio range course between Kansas City, Mo., and Burlington, Ia., upon which the pilot was depending for guidance, instead of being correctly aligned directly over the Kirksville Field, was misdirected and led the pilot about 18 miles south of the true course.'

"Mr. W. M. Lytle, Assistant Airways Keeper at Kirksville, in his affidavit says that the beam was south of the course on May 6 and had been for several days.

"Furthermore, I obtained from 1st Lieut. Homer Bredouw, on this trip, an affidavit stating that at 2:40 of the afternoon of May 6, 1935, he flew to the scene of the wreck in a radio equipped Army plane, and found the Kansas City radio beam at that time, 16 miles south of Millard Field and directly over the wreck. Mr. Bredouw's affidavit is also substantiated by his passenger, Sergeant Midel of Richards Field, Kansas City.

"I firmly believe that Pilot Bolton, that night, was direct on the beam and thought he was following it to Millard Airport from which all the good weather reports were emanating. If you measure the straight line distance from Kansas City to the scene of the accident, and from Kansas City to Millard Field, you will find that the line from Kansas City to the scene of accident is about 5 miles shorter than the line from Kansas City to Millard, and would be just about the point a pilot would be coming down through the clouds to effect a landing at Millard. I believe that when Pilot Bolton arrived at this point, he started to glide down to find the reported 1200 foot ceiling and 5-mile visibility as reported by Mr. Jones. The fact that this condition failed to exist cannot be considered otherwise than a contributory cause to the fatal crash."

ALICE IN LOONEYLAND

CY CALDWELL

● Alice was growing very tired of sitting in Potomac Park counting bicycles—she was working on a WPA bicycle-counting project and getting paid for it by the Republican tax payers, though of course she gave all the credit to the Roosevelt-Hopkins boondoggle gang. She was sitting on a nice warm bank covered with grass and loafers, all of whom, thanks to dear Dr. Roosevelt, were well fed at the expense of those still willing to work.

Alice was feeling quite sleepy herself, and was wondering why she had to work so hard counting bicycles when people like Rex Martin and Eugenie Vidal got paid so much more for not even counting their own mistakes. She was yawning and thinking this over when suddenly a White Rabbit with pink eyes and a red nose ran close by her, hurriedly consulting a watch which he took from his waistcoat pocket. "Oh dear! Oh dear! I shall be late," he was saying as he galloped past Alice, who started to her feet, for it occurred to her that this must be a very remarkable rabbit indeed—or perhaps the President of the National Aeronautic Association in disguise.

The Rabbit hurried across the park and leaped into a taxi, with Alice right behind him, for she was by nature a very inquisitive child, being the daughter of a U. S. Senator who had served on many inquisition committees. The White Rabbit looked startled at this sudden intrusion, but managed to smile patiently and say, "Get right in—I suppose you're a spy for Senator Black?"

"What gave you that idea?" asked Alice.

"I'm an American business man," replied the Rabbit, "and I'm always being spied upon and investigated. Driver, take us to the Hearings before the Subcommittee of the Committee on Appropriations of the United States Senate. Please hurry. The Duchess Eugenie is testifying today, and I don't want to miss a precious word."

"Okay," said the driver. "Keep your shirt on."

"I've lost my shirt," said the Rabbit with dignity. "I'm an airline operator. I lose 8 cents a mile for every mile I fly."

* * *

"Here we are at the Senate Hearings on H.R. 12098, a bill to take money from those who earned it and turn it over to those who couldn't earn any—that, by the way, is the chief function of government these days," said the Rabbit cheerfully as he scurried into the building and entered a room with Alice. The room was filled with a group of important looking people and others who were doing their best to look like important looking people. All were listening to a gentleman who was saying, "We have 8,500 planes in existence today in the United States. We are right on the eve of quantity manufacture of a moderate-priced plane."

"Who is that?" whispered Alice, impressed.

"That," said the White Rabbit in low tones, "is the Hon. J. M. Johnson, Assistant Secretary of Commerce. All he knows about aviation is what someone told him. His trouble is that he has listened to so much that when it rattles around in his head all he hears is a buzzing sound."

"In a couple of years," Mr. Johnson went on confidently, "the industry could easily increase the number of planes in existence from 8,500 to 50 or 60 thousand."

"He must have been listening to the Duchess," groaned the White Rabbit. "Aviation has been struggling along for 33 years to get 8,500 planes in existence—and yet the Honorable gentleman expects production to leap up to 60,000 in only two years."

"Perhaps he's heard about that $700 publicity airplane of Mr. Vidal's," suggested Alice. "Aren't there to be thousands of them built?"

"There *were* to have been," said the Rabbit, "when they got the first one so it would fly without the aid of hypodermic injections by Dr. Stearman. But to date the whole $700 airplane program is merely a comedy feature on the Kraft Cheese hour."

"When that happens," Mr. Johnson testified, "we are going to have to expand tremendously the activities of the Bureau of Air Commerce, because we would not be able to take care of 50,000 or 60,000 planes and inspect every one of them every year; but we have plans on foot that will enable us to take care of the situation."

"They can't take care of the 7,205 licensed aircraft they're supposed to be taking care of now," muttered the White Rabbit. "They haven't enough Field Inspectors for that number, and the Inspectors they have are over-worked."

"What a lot of airplanes 60,000 would be," commented Alice. "Who would fly them?"

"You'll have to ask Mr. Johnson," said the Rabbit. He consulted a paper. "Here is a Bureau of Air Commerce release stating that on April Fool's Day of this year there were exactly 14,806 Federally licensed pilots in the United States. That means that in two years Mr. Johnson would have to dig up 45,194 new pilots to join the existing 14,806 licensed pilots, or leave most of his 60,000 airplanes on the ground."

"But perhaps he doesn't want those 60,000 airplanes flown," suggested Alice. "Maybe he just wants them built to give the Naval Aircraft Factory in Philadelphia something to do besides loafing."

"No, it can't be that," mused the Rabbit. "If they had to work and really build airplanes, the Naval Aircraft Factory would bitterly resent it. Mr. Johnson wouldn't want to annoy the Navy—but he might, at that. He was in the Army, you know."

Mr. Johnson, warming up to his work, was now showing the Committee a chart depicting curves in aeronautical activities during the past ten years.

"You will notice how those curves run," Mr. Johnson told the Committee. "At the end of that curve it goes right straight up in the air. We shall have to follow it more closely."

"Does he mean that the Bureau of Air Commerce will have to be more up in the air than it is now?" Alice whispered.

"I don't see how that could be possible," replied the White Rabbit, "unless perhaps it could be up in the air and all at sea, at the same time. That is possible, you know, under the Duchess. Ah—there's the dear, dear Duchess now, tripping up to the stand."

A handsome youngish man, beautifully dressed in a hand-tailored ensemble into which he simply appeared to have been poured, now languidly took the stand and smiled ingratiatingly at the men.

"Now, Mr. Vidal," said a distinguished looking gentleman, who was distinguished especially by the fact that he looked a whole lot more intelligent than most of the gathering, "you have studied this question a long time because of your responsible position."

The White Rabbit whispered to Alice that the distinguished gentleman was Senator Copeland, who used to be a doctor but had given up poultices for politics, and that he was about to question the Duchess about a sum of $5,000,000 which had been requested by the Air Bureau for radio equipment.

"Is it your opinion," asked Senator Copeland, "that in order to have safety in the air we need to spend this much money now?"

"If the lines are to complete their schedules," replied Mr. Vidal, "and if

(*Continued on page 74*)

British Military Aircraft

(Part I)

PEYTON M. MAGRUDER

The subject of British military aircraft is of utmost interest to everyone connected with the aircraft industry. It is the purpose of this article (which will be published in two parts) to describe the composition of the Royal Air Force, the types and makes of planes used in each category, and their approximate performances. Part I describes the fighters and various types of bombers; Part II will be devoted to army co-operation and various reconnaissance aircraft, as well as a short tabulation of commercial transports, since these types are readily convertible to military use in time of war. The complete article will merely outline the situation, detailed information being difficult to obtain. For that reason only a general digest is given, rather than a comprehensive and detailed analysis.

Hawker Super-Fury Fighter

● From the standpoint of numerical strength it is estimated that the British Empire is one of the strongest powers in the air. The British have approximately 3000 combat planes, of which 1400 are kept in the British Isles, 400 assigned to the Navy, 700 with the Royal Air Force units abroad, and 500 maintained by the dominions and Empire possessions.

A glance at the picture of British military aircraft shows that the various types fall into definite categories, which while similar in some respects to those of the United States, are in reality designed for conditions peculiar to the requirements of British national defense. This fact must be kept in mind while attempting any comparison of British aircraft with that of this or any other country.

The various classes are listed in the accompanying table showing the general disposition of the Royal Air Force. It may be seen that about 50% are bombers of various classes, 25% fighters, and the remainder, army co-operation and reconnaissance types. The fighters may be compared to our pursuit and attack groups; the bombers, to our light and heavy bombers; and the remainder, to our observation type with the exception of the general reconnaissance (interceptor) which is a variation of our pursuit type. The coastal reconnaissance is similar to our patrol class, and the fleet spotter to our battleship observation plane.

Each classification consists of a number of types, some of which are obsolete, others obsolescent, and the remainder up-to-date and modern in every respect. New types in each class are being developed and delivered rapidly, and these models will be described with each classification along with the older planes now in actual use.

Fighters

The Bristol *Bulldog,* for army service, is a single-seat metal and fabric covered biplane with a supercharged Bristol Jupiter engine. It climbs to 20,000 ft. in 14 minutes, has a top speed of 170 m.p.h. at 10,000 ft. and a service ceiling of 25,000 ft. Its armament consists of two machine guns, one on each side of the cockpit.

Classification	Number of Squadrons
Fighters	22
Bombers—Day	28
Bombers—Night	13
Bombers—Torpedo	6
Bombers—Transport	5
Army Co-operation	20
Reconnaissance—General	5
Reconnaissance—Coastal	7
Reconnaissance—Fleet Spotter	10
Trainers	—
TOTAL (Approximate)	116

The Hawker *Demon* is a two-seat army fighter, metal and fabric covered, with a supercharged Rolls-Royce Kestrel V (V-12) liquid-cooled engine. It is equipped with two machine guns and two-way radio.

The Hawker *Fury* is a single-seat army fighter of the interceptor class with a speed of 214 m.p.h., equipped with a Rolls-Royce supercharged, water-cooled engine of about 600 hp. With a special Kestrel engine using evaporative cooling, its speed is 250 m.p.h.

The Gloster *Gauntlet* is a single-seat fighter with a radial Mercury VI S.2 air-cooled engine. Designed for high altitude work with the army, it has a service ceiling of 33,000 ft., climbs to 20,000 ft. in 10 minutes and has a top speed of 228 m.p.h. at 15,000 ft. Its equipment consists of two machine guns, oxygen, and radio.

The Hawker *Nimrod* is a single-seat naval adaptation of the *Fury* with greater range, flotation gear, radio, and is stressed for catapulting. Like the *Fury,* it carries two machine guns on the upper cowling.

The Hawker *Osprey* is a two-seat naval fighter with a medium supercharged Kestrel. It is similar to both the Hawker *Demon* and *Hart* and carries two machine guns as well as light bombs. It has folding wings and is equipped for floats or wheels. It may be catapulted and is used on carriers but has a landing speed of 65 m.p.h.

Vickers "Vincent" Day-Bomber

Fairey "Fox" Day-Bomber

Above: Handley Page "Heyford" Night-Bomber; below: Fairey "Hendon" Night-Bomber

There are a number of experimental fighters being developed and adopted by the R.A.F. Among these are the Hawker *Super Fury,* Gloster *Gladiator,* Bristol *Bulldog IV,* and Bristol *Mercury* 142. The *Super Fury,* a special development of the *Fury,* has tapered wings and a shorter span, and has an officially recorded speed of 250 m.p.h. The *Gladiator,* a development of the *Gauntlet* with the same engine, has a top speed of approximately 240 m.p.h. and carries four instead of two machine guns. With a 715 hp. Mercury VIII it does 260 m.p.h. at 15,500 ft.

The *Bulldog IV* (a development of the *Bulldog*), has a top speed of 208 m.p.h. at 16,000 ft. with a Mercury VI S engine and Townend cowl.

The *Mercury* 142 is a new bimotored three-place low-wing general purpose plane with 645 hp. Mercury VI engines and a reputed top speed of 268 m.p.h. with retractable landing gear and flaps. Fuselage is of the monocoque stressed-skin type, and metal has also been utilized in the wing and empennage.

The Fairey *Fantome* is one of the latest experimental models produced in the interceptor class. It has a reputed top speed of 250 mph at 1600 ft., a climbing speed of nearly 3,000 ft./min, and carries four machine guns, a 20 mm. "moteur-canon," and four 22 pound bombs.

A new Hawker fighter has also been produced. This plane has a top speed of approximately 300 m.p.h. with a V-12 engine of about 1200 hp. It is a low-wing metal and fabric covered single-seat fighter with enclosed cockpit, retractable landing gear, and flaps.

A resumé of this class shows that the average top speed of the fighters in service is approximately 200 m.p.h., but that this will approach 250 m.p.h. within a year as *Super Furies, Bulldog IV's* and *Gladiators* are delivered.

Day-Bombers

The Hawker *Hart,* a two-seater, is the basic type of the Hawker series. With a Kestrel I B, water-cooled engine and underslung radiator, its maximum speed is 184 m.p.h. and service ceiling 21,000 ft. Armament consists of two Vickers guns on the nose cowling and a Lewis in the back cockpit on a flexible mount. The Hawker *Hardy,* a development of the *Hart,* has special equipment for overseas use, and a top speed of 170 m.p.h. Empty, the plane weighs 3200 lbs.

The two-place Fairey *Gordon* is a development of the Fairey III F. It has a 525 hp. Armstrong-Siddeley Panther radial engine and is armed with one fixed gun forward and one Lewis gun in the rear cockpit.

The two-seater Westland *Wapiti* which has an empty weight of 3800 lbs., is equipped with a Jupiter engine. Its maximum speed is 140 m.p.h. at 10,000 ft., it climbs to 10,000 ft. in 9.5 minutes and it has a service ceiling of 20,700 ft. Its normal range is 550-650 miles.

The Westland *Wallace* has a 570 hp. Pegasus radial air-cooled engine and may be used either as a light bomber or for observation. Its empty weight is 3830 lbs., and its top speed is 158 m.p.h. at 10,000 ft. It climbs to 10,000 ft. in 8 minutes, has a service ceiling of 24,000 ft., and its normal range of 500 miles can be extended to 1,100 miles with extra tanks. One gun is carried forward and one or two Lewis guns are on the after cockpit. A bomb load of approximately 600 pounds can be carried, in addition to a crew of two.

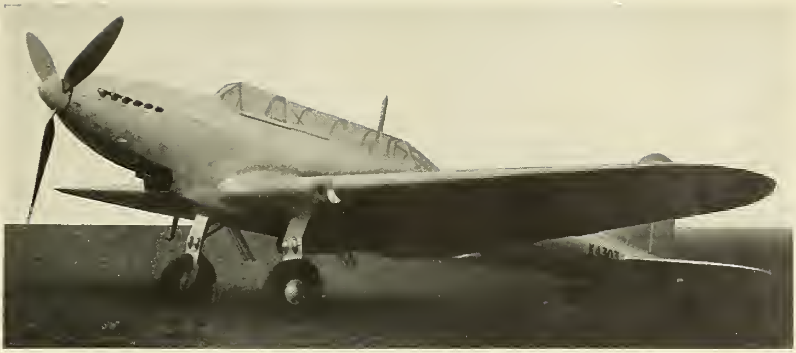
The Vickers *Vincent* is a three-place light bomber weighing empty, 4250 lbs. and powered with a 620 hp. Pegasus II M 3 engine. It is a development of the *Vildebeest* and has a maximum speed of 142 m.p.h. and a maximum endurance of 10 hours. Its normal range is 650 miles

Newest R. A. F. Fighters: (left) Hawker; (right) Gloster "Gladiator" and this may be extended to 1,250 miles with an auxiliary tank.

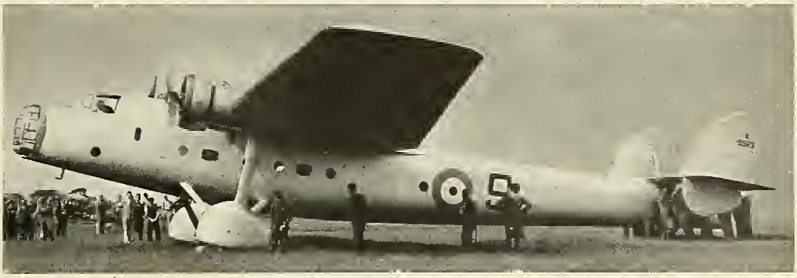
The Boulton-Paul *Overstrand* is a four-place twin-engined bomber with two Pegasus II engines and Townend rings with combined exhaust collectors. It has an empty weight of 8000 lbs., a maximum speed of 153 m.p.h. at 10,000 ft. and a service ceiling of 22,000 ft. There is a closed mechanically operated gun turret for the front gunner, a Scarff mounted gun on the rear cockpit and a prone gunner's position with a gun-mounting for defense against attack from below.

Experimental day bombers include the Hawker *Hind,* an adaptation of the *Hart* with a Kestrel VI engine and a maximum speed of 200 m.p.h., and the Vickers *Wellesley,* a long-range monoplane with a 73-ft. span, 39 ft. length, and a total weight of 10,000 lbs. With the Pegasus XVIII engine its speed is approximately 170 m.p.h.

There is also the two-place Fairey *Battle,* a low-wing cantilever monoplane of stressed skin construction and equipped with a three-bladed propeller, retractable landing gear and flaps. The plane is powered by a 12-cylinder supercharged Rolls-Royce Merlin Vee type engine, but details of its performances or weights are not available at this time, although a top speed in excess of 250 m.p.h. is modestly admitted by British authorities. Judging from the extremely clean lines of this plane, the very small and unusual radiator, and the large power plant, these claims are probably very reasonable. This plane and the Hawker monoplane fighter are undoubtedly the finest ships yet developed in England if the production types prove to have anywhere near the performance claimed for the experimental models.



Above: Fairey "Battle" Day-Bomber; below: Bristol 130 Bomber-Transport



Night-Bombers

Night bombers carry a crew of four or five or more and are designed for long range operation.

The Vickers *Virginia* is a four-place standard R.A.F. heavy, long-range type. It has two Pegasus LM III engines, and a speed of 126 m.p.h. at 5,000 ft. Its service ceiling is 17,750 ft. and it will climb to 10,000 ft. in 20 minutes. A crew of four is carried and it has guns on the cockpits forward and aft. It is equipped with bomb racks, radio, and automatic pilot, has a range of 1,100 miles, and weighs, empty, 9000 lbs.

The four-place Handley Page *Heyford* has two Kestrel III engines and a speed of 142 m.p.h. at 13,000 ft. Its service ceiling is 21,000 ft. and maximum range, 920 miles. Bombs are fused and fired electrically. It has an empty weight of 8800 lbs. and there are three machine guns on screened rotatable mountings, one of which is in a retractable cylindrical turret aft below the fuselage.

The Handley Page *Hinaidi* has two 460 hp. Jupiter VIII engines and carries a crew of four at a maximum speed of 113 m.p.h. This type is obsolete and is used in a reserve squadron only.

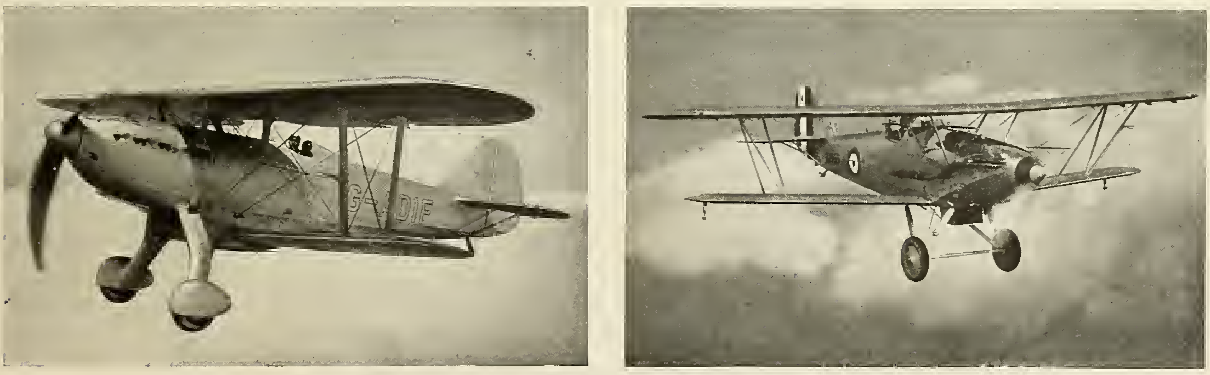
The latest experimental model of this type is the Fairey *Hendon,* a low-wing cantilever monoplane with two Kestrel engines. A gunner-bomber's cockpit is located in the nose, and two gunner's cockpits in the fuselage. Converted to a transport bomber, it can carry 15 to 20 armed troops at a speed of about 190 m.p.h.

Bomber-Transport

The Vickers *Valentia* has two Pegasus II L 3 S engines. It has an empty weight of 10,900 lbs., and it may be used as a bomber, a transport for 22 passengers, or as an ambulance. This type is utilized principally in transporting troops in Egypt, Iraq, and India.

Experimental types include the Hand-

(*Continued on page 76*)



Fairey "Fantome" Interceptor Fighter (left) and a Hawker "Demon" Fighter

The Personnel Problem in Aircraft Manufacture

(Part 1)

●

ROBERT E. CHANDLER

● The word "personnel" is not an uncommon one in industry. Its true meaning, as applied to industry, is probably the least understood of any of the fundamental functions which management is called upon to perform. When information pertaining to such work is solicited, relative to a particular organization, the reply often received is, "We do not have any such activity." This is an admission of blindness or ignorance. Wherever there are human relationships between server and served there exists this thing called personnel and its related problems.

In the broader sense of its use the term personnel management in industry today means the management of the relationships between employer and employee. In this light the inability to avoid the problem is apparent. An employer must establish relations with every one of his employees whether he cares to recognize that association or not. The degree to which he interests himself in these affairs and the manner in which he evidences this interest is the thing that determines the structure and mechanism of his personnel organization.

The aim of this work is to establish between management and labor such relations as will yield maximum labor output at minimum cost. At first this seems a simple problem, the answer to which is a low wage. This would be correct if one were dealing with a fixed stable commodity. Human beings are not that. Of all the materials and commodities which a manufacturer must procure to make his product, none are as uncertain, as variable and so difficult to analyze as the manpower. In fact the problem is so baffling that many employers do not seek an answer, but behave like the ostrich when danger approaches.

There have been individuals who have faced the question and have set about the task of unsnarling the perplexing knot. The result has been the development of a science in the field of management devoted to the study of the personnel problem. This science is not new, but, as previously mentioned, is probably the least understood of all phases of management by the average executive.

How far management can or should go in interesting itself in employee relations is a much debated question. There are countless arguments on both sides. Unfortunately there are no fixed rules or limits which may serve as a guide. The conditions of each case must be studied and analyzed by one who knows the science, and every element weighed before a decision is reached. Even the same industry located in different localities has quite dissimilar problems. The correct answer lies somewhere between two extremes. One is the failure of management to recognize the problem. The other is the case of the employer who carries his interest too far into the employee's personal habits and modes of living.

It has been definitely proven by employers in practically any field that money can be profitably spent in promoting good will among employees. These employers can also show why they figured this expenditure a profitable one. It is true that personnel work expenditures seldom show a profit on the books, but, on the other hand, sums so spent have often kept losses from appearing there. The cost of personnel work, therefore, should be thought of not in terms of making money but rather in saving it from being lost.

Boeing School of Aeronautics

The average aircraft worker is a relatively high type of employee

The range of activities which may come under the scope of personnel work in industry is wide and flexible. Again may it be mentioned that individual cases must be analyzed. Some of the more common fields of activity are employment, first aid and general medical care, plant hygiene, lunch room, locker and wash rooms, educational and training programs, recreational activities, company social functions. In the larger corporations, where active organizations are maintained, the scope carries beyond the above-mentioned fields. The benefits thus derived have been found well worthwhile and are therefore considered essential.

Nature of Employee-Employer Relations

In the light of the explanation of what constitutes personnel work it can be readily understood why this problem exists where there is an employee-employer relationship. The question is, "What type of relations shall exist?" rather than "Shall personnel work be recognized?"

Generally the nature of personnel relations found existing in industry falls into one of two classifications. It is either of the militaristic or the democratic type. In the one case management is the sole dictator of policies and their enforcement. The other extreme is a situation in which employees are permitted to enact and enforce their own governing policies. There are numerous examples of each of these practices, as well as almost every conceivable combination of them. All have their respective merits and most have some disadvantages. The problem is one which necessitates deliberation before a satisfactory conclusion can be reached. Before attempting the creation of a recognized personnel department the management must decide which course it is to follow and then adhere to those principles. A continual shifting of policy is disastrous. It tends toward favoritism, sacrificing worker respect and confidence and often agitates trouble that otherwise would not occur.

The advocates of the militaristic type of organization take the stand that management knows far better what can and should be done than the employee. They are in touch with all phases of the business and have information upon which to base their judgement that must not be made public. Another argument is that the managing executives are executives because they possess superior qualifications over the general run of employees and because of this superiority are better suited to dictate policies. Theoretically a fine argument, but too often not true, as anyone who has had the opportunity of observing knows. Pull, luck or "breaks" have been responsible for the creation of far more executives than long, honest service and real capability.

Development of the democratic form of personnel policy is relatively new. Its justification is based upon certain well-known and proved psychological facts. It is claimed that employees will adhere more readily to rules they themselves have established than those which are imposed upon them, whether they be good rules or unfair ones. The greatest value of such a policy lies in the feeling of good will it promotes among employees. This idea has made rapid strides in the past few years. Its further development was retarded by the recent economic slump, but it is expected that its early growth will be continued.

Labor seems to be demanding recognition. From the management's standpoint it may be wiser to give such recognition than have it forced upon it by some outside agency. Contrary to prevalent belief, such a course does not necessarily mean surrendering the reins of management to labor. The wage earner is just as anxious to keep his job as management is to show a profit. If these factors of industry can be brought together to consider their problems before each other they will find much in common and much of mutual benefit. A word of warning might be appropriate. Where such a policy is to be adopted consider carefully the class of worker. It is doubtful if enough is known about this form of organization to justify its use except with a relatively high type of employee. The average aircraft worker comes within this restriction.

It cannot be truthfully said that one of these policies is superior to the other. Both are good—either is bad—depending on their execution.

Justification of Organized Personnel Work

If any measure of success is to be gained through organized and executed personnel control it must serve management and labor alike. Each must contribute its share or the program will fail. Such work entails the expenditure of capital. Management naturally asks, "What do we get for the expenditure?"

Probably the most valuable return is in the form of employee good will, worker loyalty, morale, or some other equally intangible term. There is no question as to the value of this—whatever it may be called. Its presence has saved more than one organization when the going was tough. The absence of it has spelled failure for others that seemed to have everything. No system of management has yet been devised that can operate efficiently if the employees are not for it. On the other hand, systems that are so bad that they are not systems from the scientific standpoint, have worked out.

Management is prone to evaluate in terms of dollars and cents because that is the yard stick by which it is judged. So much of the work of organized personnel control cannot be measured in this manner. There are numerous instances, however, where the monetary yard stick can be used. One outstanding case is in the matter of labor turnover. Another is in educating both worker and foreman in the best and most efficient methods of performing their duties. A complete and thorough analysis of the job will result in a more advantageous use of the labor employed, which in turn should result in substantial savings. This tends toward another field of management not inherently connected with true personnel control.

Besides this intangible value of worker loyalty or morale there are other phases of personnel work, equally as intangible, that contribute to the efficiency of the worker and thus result in savings. The proper selection of workers and their placement is important. Much loss of time from illness and injury can be avoided through plant medical facilities and hygienic supervision. The provision of suitable eating facilities is an activity that is far from being purely philanthropic on the part of the employer. These things contribute to the aim of personnel work —low labor costs.

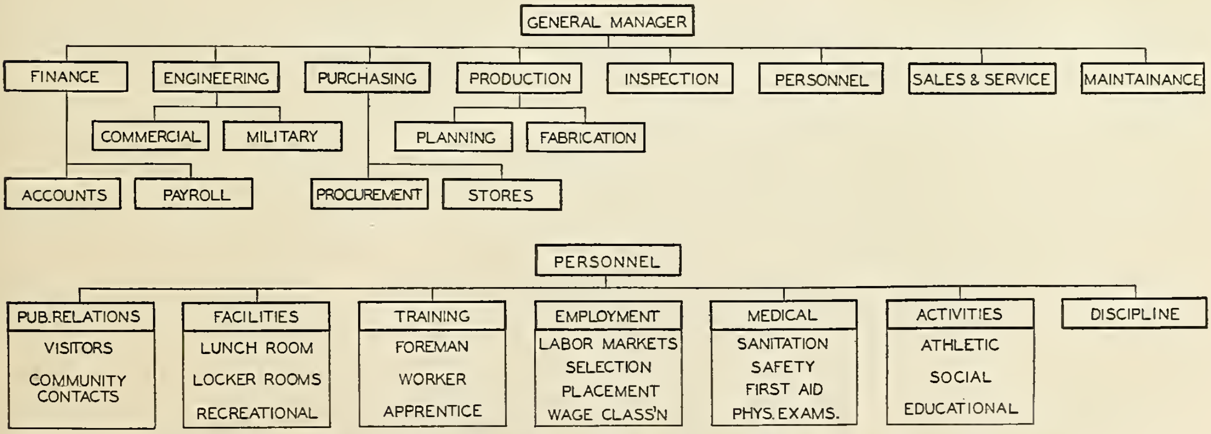
The justification of such work from the workers' standpoint is obvious. The employer is paying a certain wage for a man's services. Surely the worker will be grateful to an employer who makes it easier for him to give that service or makes his working surroundings more pleasant. If he can be shown ways of accomplishing more work in the same length of time, with a minimum expenditure of effort, and still receive a higher wage for that increased output, he will be better satisfied. On the whole the wage earner appreciates any interest the employer exhibits in improving his condition.

Relation of Personnel Work to Other Phases

Personnel control is a function of management. It deals with man power, or human beings, and therefore becomes one of management's problems wherever it is necessary to use labor. Its scope is the entire factory, from the watchman to the shipping clerk, who is the last man to handle the product before it reaches the customer. Other phases of management have definite bounds or limits of activity. They are concerned with only that portion of the work which is their particular job. Not so with personnel. Its responsibility extends to every division of the manufacturing process that utilizes man power. It is concerned with office and factory worker alike, with engineer and salesman. With such far reaching responsibilities, the necessity of flexibility in the personnel organization is apparent.

With these diversified interests, covering the entire organization, it is only to be expected that there will be an overlapping of responsibility or jurisdiction. Where does this jurisdiction stop? Where does it begin? Again it must be said that the question can be answered only after study and analysis and a predetermined policy. In some cases the lines will be clearly cut. In others they may never be exactly determined. One of the most common points of overlapping is in question of wage incentives and rate setting.

Ordinarily the greater portion of this work comes under the Industrial Engineer or the Time Study man. It is his duty to determine what the job involves and



Functional organization chart of typical aircraft factory, and the possible activities of the personnel department

Photos courtesy Cleveland Graphite Bronze Co.

Modern factory medical and cafeteria facilities reduce time lost and help maintain worker efficiency

the time in which it should be performed, as well as methods of performance. Where the organization is not of sufficient size to justify such a department, or where the nature of the product does not lend itself well to minute analysis, what is done may well be performed in conjunction with personnel work. The aircraft industry is still far away from profitable time and motion study of even its most elementary operations. What work is done in the way of developing wage incentive systems and the establishing of rates should be left as a function of personnel activity.

Precaution should be observed by personnel administrators against attempting to usurp the functions of other phases of the management. One in such a position must not lose sight of the fact that his duty and chief concern is personnel work and not that of the general superintendent. Failure to do so dooms the success of his work as well as his position. Cooperation is the keynote of successful personnel activities. It must exist between management functions as well as between the employee and the management. The job of the personnel department is to see that this condition exists.

Application of Management Principles

The principles of scientific personnel management have been outlined in the foregoing discussion. These are not new to management. All have been tried and proved sound. Their use has been one of the most efficient means management has had of increasing productivity with the smallest possible expenditure of funds. To be sure there is a point where sums spent in such work do not obtain results in keeping with the cost involved. At that point, or before it is reached, is where organized personnel work should be discontinued.

When the movement was first being inaugurated, such programs were advised and tried only in the larger organizations. As their success was recognized smaller establishments resorted to the idea with similar results. It was not long until organizations at first considered too small for profitable use of such methods were enjoying the benefits obtained through the application of these principles. Again, the nature of the business is an important factor, but, it can be safely said that in general manufacturing plants with more than 350 or 400 employees organized personnel departments can be used profitably. Where the nature of the work necessitates the use of much highly skilled hand labor even smaller organizations than indicated above can use it. Modern aircraft manufacture is characteristic of this class of industry.

With a fundamental understanding of the basic principles of personnel management in mind we can now turn our attention to the discussion of a particular industry. This is necessary because all industries present particular problems, regardless of how many points of similarity they may possess. Let us now consider those problems found in the aircraft industry, and, if possible, their solutions.

Before a comprehensive analysis of the personnel problems involved in modern aircraft manufacture can be made, and possible solutions to these problems offered, consideration must be given to the nature of the product. This fact in itself presents difficulties which have been experienced to little extent in other fields.

Economic Considerations

In spite of the publicity given it by the press and by enthusiastic laymen the aircraft industry is still in its infancy. Too often it is compared to the automobile industry as a possibility of future industrial development. Yet the only sound basis of similarity between them is the fact that both products are vehicles of transportation.

Contrary to general belief, the airplane is almost as old as the automobile, less than ten years separating their origin. Today one occupies a position of tremendous economic importance in our industrial system because of the influence it wields over such a large portion of our wage-earning public. The other is of scarcely recognizable economic value. The cause of this difference can be summed up in one word—markets.

Considerable publicity has been devoted to the possibility of developing a practical airplane to sell in the same price field as the modern medium-priced car. But that is not the answer. There are other problems, some financial, others economic and still others, human physical problems. These tend to retard mass production of aircraft which must be attained before the two industries can be compared on an equal basis.

Assuming these economic limitations to be inherently a part of the product, as all past and present indications lead one to believe, the industrial production of aircraft is the production of a relatively small number of units of a highly specialized and increasingly complicated product.

Need of Personnel Organization

As in other similar cases, direct labor costs in aircraft production represent a large proportion to the total manufacturing expense. Just what part of the entire cost is represented by direct labor charges depends to a great extent on the type and quantity of ships being built. This probably varies from fifty to eighty percent in the case of experimental projects.

Another expensive factor in the production of aircraft is the high cost of material. Producers have recognized this fact and have taken steps to cut expenditures. This has been done through the development of planning and purchasing organizations, and considerable savings

(*Continued on page* 80)

EDITORIALS

> "No epic of the past surpasses the magnificent achievement of Lincoln Ellsworth's last exploration in the Antarctic. Launched on a long and hazardous flight across unknown and uninhabited lands, he and his intrepid pilot landed again and again in a wilderness of ice-covered mountains. There they calmly made their observations, waited for favorable weather and then took off again for their distant objective, navigating the while with such accuracy that when their fuel was exhausted they were within twenty miles of their goal."
>
> —ROLAND L. REDMOND, President, Geographical Society

Fifth-Rate Protection

● The United States, among the seven air powers of the world, occupies fifth place in numbers of combat planes its air forces have immediately available for an emergency. That not only is the same unenviable position it held a year ago; it is even more serious, for all other powers are equipping their air forces far more extensively than is the United States.

In Government support, the American industry has not fared very well. On the other hand, during the past two years, Great Britain, France, Italy and Germany have been doubling government expenditures with their aviation industries, at the same time setting up experimental laboratories in some instances modeled after those here. They are doing all that with full appreciation that it is worth more than it costs. That is why foreign countries are speedily progressing while we coast along on the momentum of the past, and the rather hesitant support of a government confused as to what best to to do to develop American air transportation and also meet the need for national defense.

Some hope exists as a result of recent House action. Bills for 4000 planes (extending over a period of 5 years), an expanded air corps personnel, an air reserve training corps, and for a revised system of promotion were unanimously passed and are now in the Senate. But, before tangible good can come from the bill for more aircraft (even if it passes the Senate), sufficient funds must be appropriated for their purchase. With the present emaciated condition of our treasury and the ever-mounting public debt, what chance is there for funds to be forthcoming unless the man in the street can be aroused to the realization of the danger to any first-rate nation with fifth-rate protection?

Belated Recognition

● At last comes "recognition" for Brigadier General William Mitchell! The Senate, anxious to show fittingly its appreciation for the courageous and meritorious (and single-handed) work of the General in calling public attention to defects in our air defenses, has decided to make him posthumous award of its Medal of Honor. So the General who risked everything for his convictions is now honored in death.

Suspended on half pay for his audacity in voicing constructive criticism where less sturdy souls stammered and remained silent, he had been practically forced to resign from his post.

Now that he is stilled for all time, Congress emerges from its shell and goes through the ceremony of paying homage to his memory. What recompense for a fighting leader whose policies are now regarded as sound and reasonable, though rejected as absurd and needlessly alarming but a few short years ago!

Despite the clumsy handling he received in return for his self-sacrificing efforts on behalf of the aviation industry, his spirit was undaunted. And in the years to come he will be remembered not as another recipient of the Congressional Medal of Honor, but rather as a true patriot whose spirit still lives to remind a slow-thinking Congress of its duty to trusting citizens.

Vacations By Air

● Aerial vacations in any part of the continent are now a reality in this country. European airlines have offered this service for some time, but American airlines are pioneering in providing circle air tours to principal points of interest in the United States, Canada and Mexico.

The advantages of this type of vacation tour are obvious, of course. They allow the person who must plan a vacation within the customary one or two weeks to visit more points of interest and spend more time seeing the sights than is possible with other forms of transportation.

Travel promoters should be preparing to make these splendid possibilities generally understood. Four years ago, Aero Digest (in the April 1932 issue) indicated the enormous potentialities of the aerial vacation, pointing out that the expense would be on a par with the motor car, boat, or train; the time saved by this quicker mode of transportation would enable more sightseeing, a greater diversification of places visited, and the experience of seeing new places from the air as well as on the ground.

What Price Records?

● The NAA has been appealing to American pilots to keep supremacy in aerial record-holding in this country. Every time some foreign pilot sets a new record, our pilots must set one, too. Otherwise we would soon relinquish our lead in this important branch of aeronautics.

Pilots are accustomed to most of the red tape connected with a record attempt; they do not mind the overhaul costs, fuel costs, and the risk. But, why should they be called upon to pay $15 to $25 for "sanction fees," $5 to $10 for a baragraph calibration (that should be done without charge by the Bureau of Standards), $10 for having it written in the national record book, and $20 to have it written into the F.A.I. records. The $50 deposit for the baragraph and the $5 fee for its use is reasonable, but other fees savor of racketeering. Particularly do we refer to the appointment of the registered F.A.I. timers who must clock closed circuit speed attempts to make them official, and who may charge as high as $25 a day for their services.

If the NAA wants American pilots to keep us in the lead let it eliminate the sanction fee, the cost of writing the record into the books and a few other pet charges that are tacked on to bolster its weakening financial structure and add to its dwindling exchequer.

Decrease in Aircraft Accidents

● A National Safety Council press release states "accidents of all types took 99,000 lives during 1935" following with "the motor vehicle deaths total last year registered an all-time high, increasing one percent over the 1934 figure . . . railroad deaths were about the same as in 1934"—but—"There was only a small *decrease* in airplane deaths." (Our italics).

For full appreciation of these significant statistics we must bear in mind that the number of passengers flown in 1935 established a new record in the steadily expanding air transportation system, paralleled with a considerable growth in private flying in all parts of the United States.

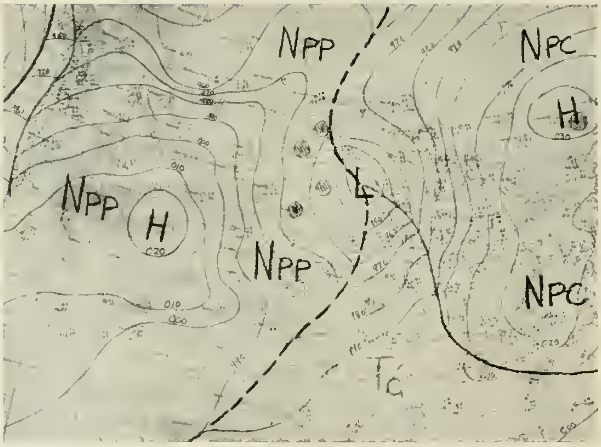
AIR MASS ANALYSIS

Third of a series of articles on the subject of Flying Weather

●

WILLIAM H. WENSTROM

Captain, U.S.A., Meteorological Officer for
Bolling Field, D. C., and Third Corps Area



Portion of a weather map of N. America

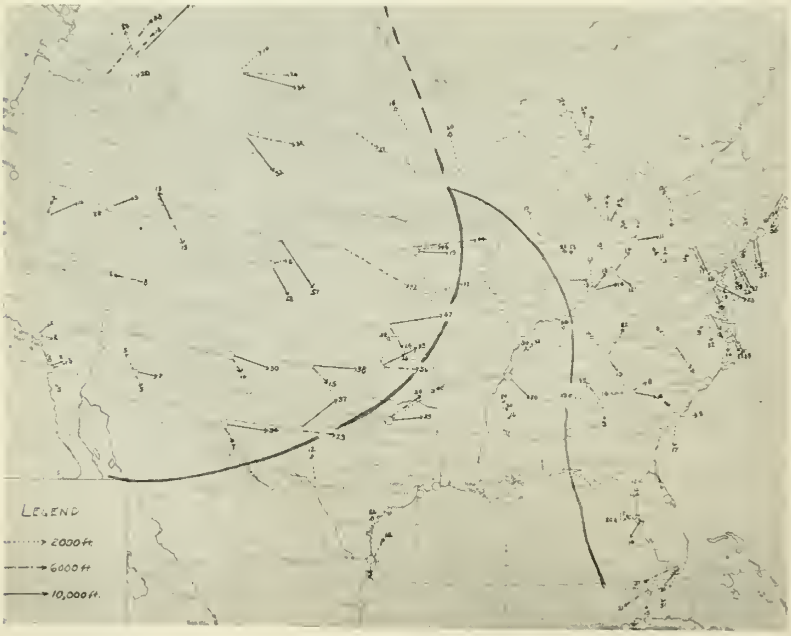
● Surface measurements and observations, valuable as they are, give an incomplete picture of conditions in the atmosphere. New air masses may appear, quite unexpectedly, at higher levels. The blue sky of early morning may result, on one day, in a clear, hot afternoon; and on another (due to different air mass conditions) in violent thunderstorms. The only complete test of conditions aloft is an actual sounding into the depths above.

Upper Air Soundings

Every morning, weather permitting, an aerial sounding is made by airplane at each of about twenty-four stations scattered over the United States. The aerograph, which automatically records the values of air pressure, air temperature and relative humidity it encounters during an ascent, is mounted well out from the fuselage, so far as possible in the undisturbed slipstream. After a calibration glide from low altitude back to ground level, the climb to about 16,000 ft. is made rather slowly, taking about an hour's time in order to allow for lag in the instruments. The instrumental records are then evaluated by technicians, during the course of another hour or so, into a form that can be readily used by weather analysts.

This airplane sounding technique, while better than the kite method formerly used, leaves much to be desired. Taking soundings before sunrise, often through thousands of feet of clouds marked by icing or other dangerous phenomena, is an onerous task for pilot and observer. Weather conditions are often such that a sounding flight must be cancelled entirely; and, unfortunately, it is in just these weather conditions when meteorologists need soundings most.

These difficulties are being surmounted by the radiosonde or radio sounding balloon, which is being developed in Finland, and at the Blue Hill Observatory of Harvard University in this country. A small rubber balloon, rising freely at about 500 ft./min., carries aloft a small, light-weight aerograph connected to a small, light radio transmitter in such a way that the radio signals, as received at the ground station, continuously indicate the values of temperature, pressure and humidity being encountered by the device. Evaluation of the sounding can proceed during the ascent, which may be made day or night and in any weather.



Upper wind map showing how upper winds blow about a typical cyclone

Analyzing Air Masses

The aerograph record of a sounding gives directly the values of pressure, temperature and relative humidity encountered at various levels. These data are then evaluated into forms that will show the various air mass qualities, such as stability, temperature or moisture stratification, or the like, in a clear and complete manner. Data are first plotted in the form of an adiabatic diagram. Temperature is plotted against pressure, and relative humidity may also be plotted against pressure. As pressure always decreases with increasing altitude, the vertical ordinate may be said to represent either decreasing pressure or increasing altitude. The temperature *vs.* pressure (or altitude) curve then shows, at a glance, how the temperature varies aloft, and where abnormalities such as temperature inversions (stable layers tending to oppose vertical currents) are located. On the adiabatic diagram one can find critical points where there is a marked change in air mass characteristics. By computations involving pressure and temperature (and relative humidity as well, if accuracy is desired), the evaluating technicial finds the true altitude at each of these selected points (or levels), which may differ by several hundred feet from the airplane altimeter readings. The evaluator also obtains the values of pressure, temperature and humidity at each selected

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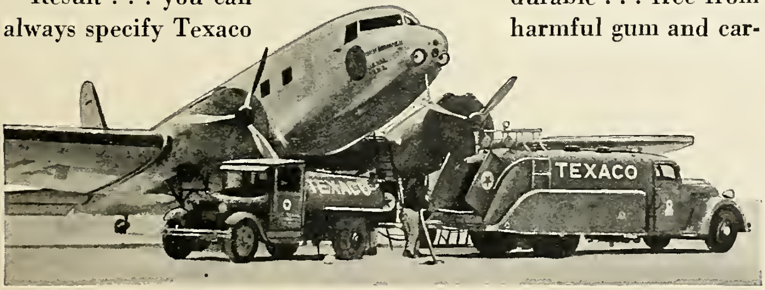


TEXACO *Aviation Products*

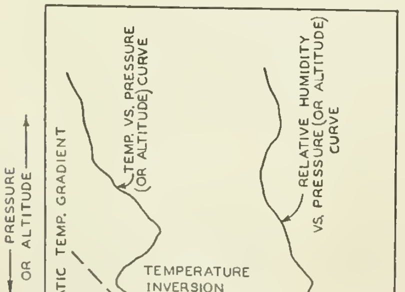
(*Continued from preceding page*)

level, and sends this information out for general distribution.

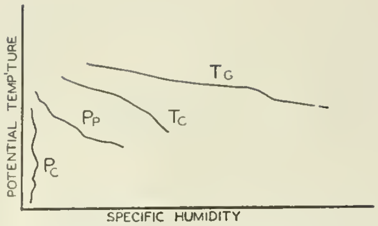
The quantitative analysis of a sounding and the air mass that it represents is best accomplished by considering those characteristics that are most conservative, or least subject to change as the air mass travels horizontally, rises, or sinks. A conservative measure of moisture as well as a conservative measure of temperature is needed. The conservative measure of moisture is specific humidity, mentioned in a previous article. If the specific humidity of an air sample is 3g/kg at the surface, it is 3g/kg as the air sample rises miles above the surface, provided no condensation occurs. A conservative measure of temperature is potential temperature; that is, the temperature an air sample would have if its pressure were changed to sea-level standard. As an air sample rises, pressure, temperature and relative humidity change; but barring condensation, specific humidity and potential temperature remain the same.

As a further step in evaluating the sounding, therefore, specific humidity and potential temperature are determined at the selected levels above the ground. The results are plotted in the form of a curve on a Rossby Diagram (developed at Massachusetts Institute of Technology), a chart having specific humidity and potential temperature as coordinates. The vertical curve in the accompanying illustration, marked Pc, for example, represents a sounding in cold, dry polar continental air, while the nearly horizontal curve marked Tg represents a sounding in warm, moist tropical gulf air. Any distinctive air mass is thus represented by a typical curve falling in a different place on the chart, and the air mass can be identified from the chart at the same time that its detailed characteristics are being studied.

At a complete forecasting station the sounding can be further used in additional diagrams. The tephigram and the emagram are designed to show the energy available aloft for convective overturning, and help in forecasting instability showers and thunderstorms. The atmospheric cross section, on which several soundings are plotted along a N-S or E-W line across the country, shows a vertical section of the actual fronts and air masses similar to the typical sections of warm and cold fronts accompanying the second article of this series.



Simplified adiabatic diagram



Simplified Rossby diagram

American Air Masses

One of the fundamental principles of physical weather analysis, as we have seen in previous articles, is that a large air mass acquires in its source region characteristics that change but slowly as it moves elsewhere. Therefore it should be possible to classify the various types of air masses that invade the American weather scene; and to identify each new air mass by soundings, as it appears, in terms of its source region and typical characteristics. Such a study has been made at M.I.T., and its results may be summarized as follows:

Polar Continental (Pc) air masses originate over the Arctic Regions, northern Canada and Alaska. They are characterized in summer by moderate temperature and humidity, and in winter by very low temperature and humidity. They are quite stable in winter (except when advancing southward from the Great Lakes and other large bodies of water), fairly stable in summer, and generally attended by clear skies, except south of the Lakes in winter.

Polar Atlantic (Pa) air masses originate over the colder portions of the northern Atlantic Ocean. They are characterized by low to moderate temperature and moderate humidity, some instability at lower levels, and low stratus clouds. They seldom extend far south or west of New England.

Polar Pacific (Pp) air masses originate over Bering Sea and the northern Pacific Ocean. They are characterized in summer by moderate temperature and humidity, and in winter by low temperature and moderate humidity. They are usually rather unstable, becoming very unstable in winter and spring, when their progress across the western United States is attended by heavy cumulus clouds and precipitation. Over the central United States in summer, Polar Pacific air is much like Polar Continental air.

Tropical Gulf (Tg) air masses originate over the Gulf of Mexico and the Caribbean Sea. Tropical Atlantic (Ta) air masses originate over the Sargasso Sea. Both types have similar characteristics. They are characterized in summer by high temperature and very high humidity and in winter by fairly high temperature and high humidity. They are conditionally unstable at all levels, easily forming heavy cumulus clouds with showers and thunderstorms.

Tropical Pacific (Tp) air masses originate over the Pacific Ocean northeast of Hawaii. They are characterized by moderate temperature, fairly high humidity, and neutral stability, forming stratus clouds when forced to rise. Tropical Pacific air is found mostly along the Pacific Coast, but sometimes extends east of the Rockies at high altitudes.

Tropical Continental (Tc) air masses, which appear only in summer, originate over Mexico and Southwest. They are characterized by very high temperature, moderate to low humidity, and generally clear skies despite considerable instability. Warm, dry air masses having Tc characteristics sometimes appear aloft over wide regions of the United States in winter and summer alike. They are thought to originate at high levels in the sub-tropical belt of high pressure, and are designated by the symbol Ts.

To the meteorologist each of these symbols means a distinct type of air having certain characteristics. Using the symbol Pc in midwinter, for example, he thinks of air coming from the frozen wastes around Hudson Bay, air that is cold and dry, not only at the surface but also aloft. Using the symbol Tg in midsummer, he thinks of warm air nearly saturated with moisture, air in which great cumulus clouds will build up under the sun's heat, probably becoming lofty thunderheads by afternoon. After an extreme type of air has been over the United States for a day or two, the transitional "N" is usually added to its symbol. In the weather map reproduced with this article, for example, the air west of the occlusion is called NPp because it has been over the continent for two days. The NPc air ahead of the warm front is perhaps three days out of the Hudson Bay region. But the Tg air coming up from the south is scarcely a day away from the Gulf. The naming and renaming of an air mass is thus a matter for the meteorologist. If he knows what he means by a symbol in the way of weather and air characteristics, fine points of nomenclature are unimportant; particularly so, because complete analysis includes much more than the qualitative name.

Lower Winds and Upper Winds

From a meteorological viewpoint the most typical and best behaved winds are the gradient winds, which normally occur between altitudes of 500 and 2000 ft.,

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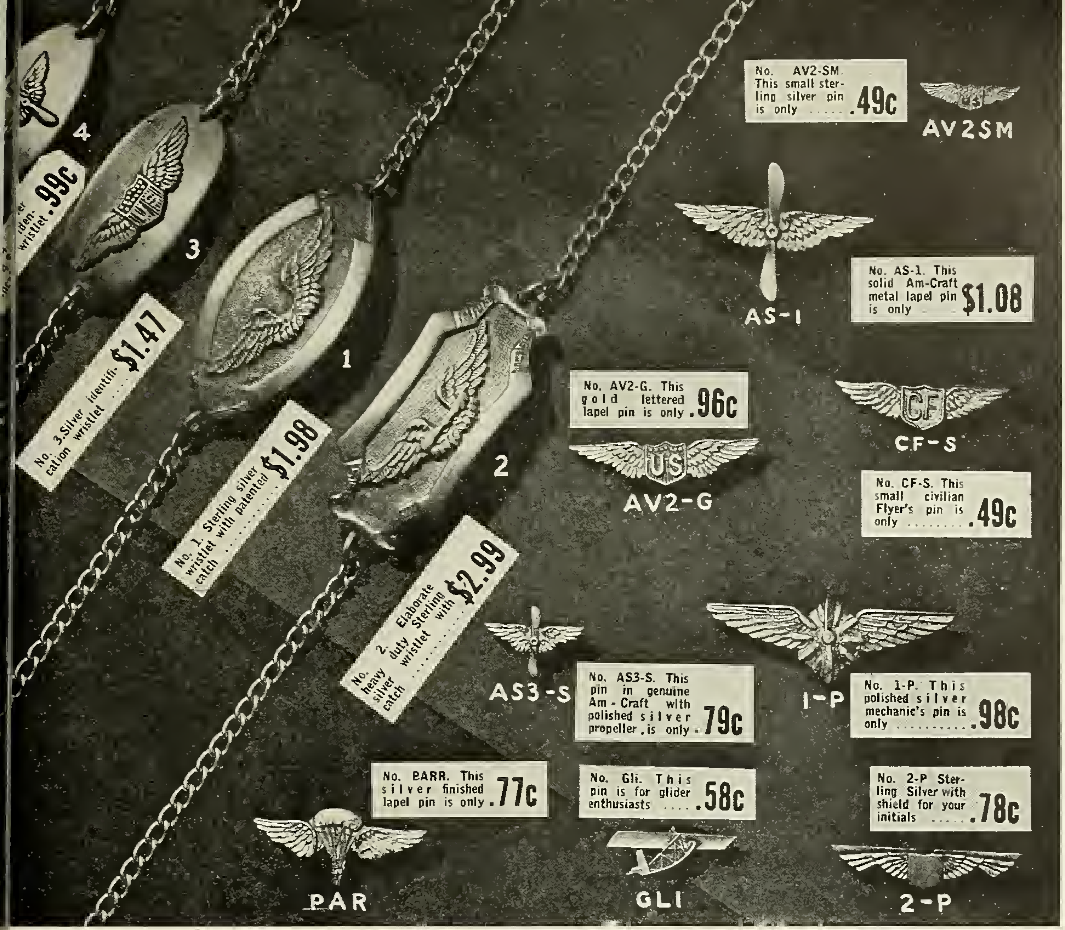

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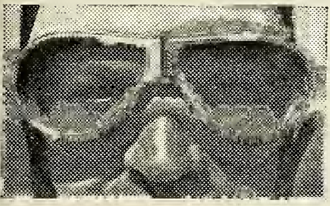

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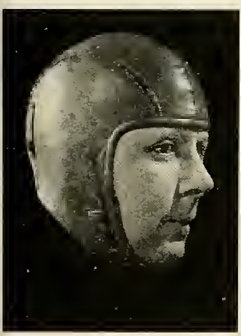

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(Continued from preceding page)

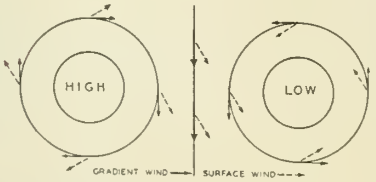
and often bear a close relation to the pressure field.

This relation is closest in the case of a stationary high, or a circular low. If the high is moving rapidly, it merely represents the enormous push and momentum of untold billions of tons of air, and all its gradient winds are likely to be in one direction—that in which the whole air mass is moving. If the high is slow-moving or stationary, however, three balanced forces—pressure gradient, deflection due to the earth's rotation, and centrifugal force—cause the gradient winds to blow circularly about the high in a clockwise direction (on the northern hemisphere), closely paralleling isobars.

A truly circular low has no marked fronts in its immediate cyclone area. The perfect example of such a low is a tropical hurricane, but many slow-moving or stationary temperate cyclones at times approach circular form. About such a low the gradient winds blow circularly along the isobars in a counter-clockwise direction (on the northern hemisphere), urged by the three forces mentioned above.

The gradient wind speed depends on the intensity of the pressure field. The closer together the isobars are, the higher the winds will be. At gradient levels the winds blow nearly parallel to the isobars; but near the earth's surface they veer towards the pressure gradient, because, near the ground, surface friction disturbs the perfect equilibrium of forces that drive the gradient winds. Over average terrain, this turning of the surface wind towards the pressure gradient (that is, the gradient from high pressure to low pressure), averages about 30°.

As the turning of surface winds towards the pressure gradient is caused by surface friction, we should expect the amount of this turning to vary with different terrain. Over open sea or very flat country the turning is slight; the direction of the surface wind is usually within 20° of the gradient, and its speed is about 70% of the gradient speed. Over ordinary rolling country the turning is usually 30° or more, and the speed ratio only about 40%. Over such mountainous country as the Rocky Mountains or Southern California, the turning may be as much as 90°; there is no gradient wind in the ordinary sense, and the air blows straight out of the high or towards the low, often producing warm, dry foehn winds in and below the mountain passes.



Typical wind circulations

Winds above gradient levels are more irregular. In temperate latitudes (the region of the prevailing westerlies) they usually blow in general from west to east, though this rule has many exceptions. Strong northward or southward drifts are also common, and high east-west drifts are not unknown. The prevailing westerlies normally increase in velocity up to the base of the stratosphere (found at about 7 miles altitude in temperate regions), where their average speed is around 60 m.p.h. Above the 7-mile level the winds decrease with increasing altitude to mere drifts of a few miles an hour. At levels above 12 miles or so, a marked east-west drift has been observed.

Upper winds are usually measured by small pilot balloons of thin rubber, hydrogen inflated to a diameter of about two feet, which rise freely at several hundred feet per minute. Two theodolites at known positions on the ground are sighted on the balloon at successive predetermined periods, usually a minute apart. Thus the successive positions in space of the balloon, and hence the wind speeds at successive levels, are determined. As the rise rate of a balloon inflated to a known displacement is quite constant, and may be assumed, most routine pilot balloon observations are made with a single theodolite. This single-theodolite method is simpler and quicker, though individual runs may give inaccurate results. For night observations, a small candle lantern is hung below the balloon; or in Western forest regions, a small electric light.

About 60 stations scattered over the United States make regular upper-wind observations, which usually extend to altitudes of 10,000 or 15,000 ft., two or three times daily. These observations are usually plotted on an upper wind map such as the one reproduced with this article. In view of recent developments in high-altitude flight operations, it begins to appear that wind observations to higher altitudes will soon be needed. The U. S. Army Meteorological Service is already experimenting with larger pilot balloons that can be followed to 40,000 ft. or more under clear skies in the day time. At night these balloons carry lanterns and can be followed to 25,000 ft. or so.

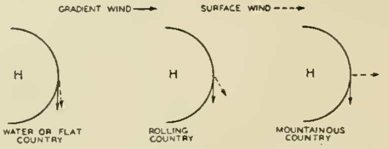
Bumps, Rough Air, Turbulence

Aside from steady high winds aloft and on the ground, the air motion of most interest to pilots is turbulence. Turbulence results from the deflection of wind by terrain features, from vertical currents in the atmosphere, and from gustiness (or variations in wind direction and velocity). These causes are at least partly related, and all tend to make the air "bumpy" for flying. Ordinarily this bumpiness is a matter of little concern to pilots, but under some circumstances it can be dangerous.

Wind deflection by terrain features is most pronounced in high winds blowing over and around large and abrupt obstructions. Rising currents on the windward slopes of mountain ranges are well known, and are sometimes used for soaring. Downward currents to leeward of mountains are equally common, and are more likely to be embarrassing to pilots. The more jagged and angular the obstruction is, the higher the wind, the more violent will be the resulting disturbance; and this disturbance may include, besides simple down-drafts, various irregular eddies and vortices. Pilots who have crossed the Alleghenies under a low ceiling, bucking a westerly gale, know how crazily a ship can bounce around in these variable currents. In certain extreme wind situations around really high mountains, these eddies may take the form of air "waterfalls," with turbulence so excessive that structural damage is likely, and downward currents so strong that no airplane can maintain altitude in them.

Smaller obstructions such as low hills can produce wind-turbulence on gusty days that may be dangerous at near-stalling speeds. Large buildings can also cause noticeable eddies, and in high winds the immediate vicinity of any large bulk, such as an airship hangar, should be approached with care. If the wind itself is very gusty, it may cause difficulties at low altitude over any sort of terrain, for under extreme conditions the wind velocity may vary within a few seconds by 20 or 30 m.p.h. An airplane landing slowly under such conditions as these may have flying speed one moment, and lack it the next.

Aside from these wind and terrain effects, violent rising and falling currents can be set up in free air that is moist enough and sufficiently unstable. These rising currents are usually marked by cumulus clouds; the larger and higher the clouds, the more violent their currents are likely to be. In some towering thunderstorms which produce large-sized hail, (fortunately a rare occurrence) updraft speeds are between 100 and 200 m.p.h. The turbulence associated with cumulus clouds can be at least partly avoided by flying well below the ceiling; or by flying as high as possible—say above 10,000 ft.—where the updrafts have lost much of their force in rapidly thinning air. The middle region, just below the ceiling and for some distance above it, is usually the turbulence maximum. Many pilots have a habit of hugging the ceiling when they could find quieter air with reasonably adequate altitude below.



Winds over various terrain

THE SKY'S THE LIMIT

Noteworthy indeed is the progress of American Aviation during the depression years. The past decade, from the birth of commercial aviation to World's leadership, points the way to still greater achievements. Then 225 horsepower motors carried a maximum of 300 pounds of mail. Today 36 passenger transports weighing over 25 tons are winging their way over home and foreign routes.

And "Ground Aids," of necessity have kept pace, for speed, safety and comfort in the air are conceived and attained on the ground. Always playing an even greater part in Aviation's progress are the modern airports with their modern fields, their modern hangars for larger ships and other modern facilities. Typical of this advancement is the modern hangar illustrated above, housing as it does, the important "Ground Aids" of aviation. It is part and parcel of the industry, designed, engineered and built to meet every demand of air transportation.

This modern hangar is one example of the service which Austin Executives are prepared to offer management in this field. Whatever may be required from the complete airport to any single building Austin can deliver under an experienced plan of complete service.

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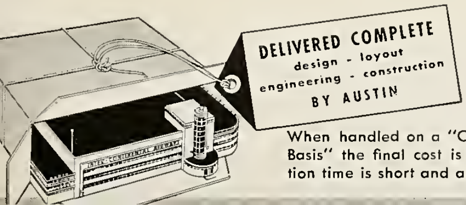

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These are savings that can be achieved by all builders. We are hopeful that every builder will take advantage of the quite measurable economies offered in this example of design room—shop floor co-ordination. ALUMINUM COMPANY OF AMERICA, 2194 Gulf Building, Pittsburgh, Pa.

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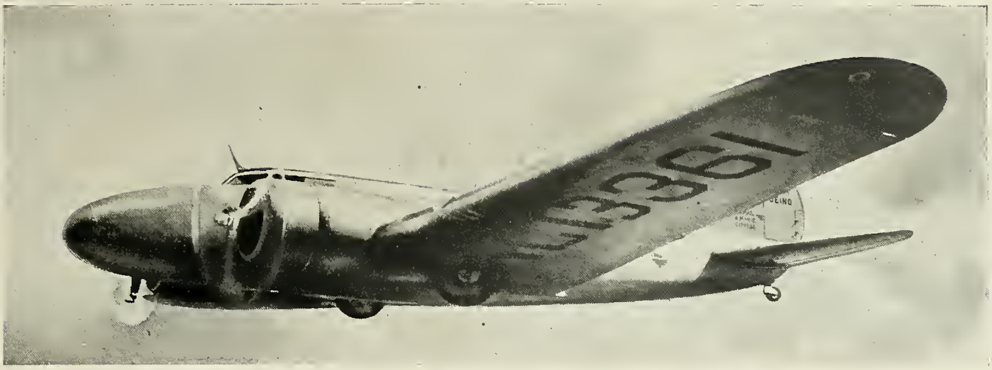

Flight view of a Boeing 247-D, one of fifty such transports now flown by United Air Lines

TEN YEARS OF AIR TRANSPORTATION

● Just ten years ago the Post Office Department turned over air mail operations to private enterprises and the air transport industry entered the threshold of one of the most remarkable achievements in the history of transportation.

Today we look back at a record breaking year in 1935 when 860,761 passengers topped all records by flying with regularly scheduled American lines, and regular trans-oceanic service was inaugurated.

Operating equipment unequaled anywhere in speed, safety and convenience, these airline companies are making further progress toward enhancing and improving the service they offer the travelling public. Even now, they have formulated plans for huge four-engined planes with facilities for 40 or more passengers, thus replacing equipment that is comparatively new in point of service, but inadequate in meeting anticipated demands.

Substratosphere flying may be the next step in the development of air transportation, while further impetus may be expected when the United States follows the lead of England and places all non-local first class mail in the air.

Last month marked the tenth anniversary of three of the oldest (either directly or indirectly) companies flying today, and it is not inappropriate to review the past from this milestone.

Western Air Express

By way of affording a contrast between the past and present, Western Air Express re-enacted its first air mail flight (April 17, 1926) with the identical plane and men. Not purely a sentimental gesture, the purpose primarily was to focus public attention on the improvements in equipment and facilities available today in safe and dependable air transport.

The U. S. Post Office Department established the first air mail route in 1919 between New York and Washington. By the following year a transcontinental service had developed between New York and San Francisco. Western Air Express has, from the beginning, flown its passengers, mail and express over an integral sector of this airway diverging at Salt Lake City to Southern California.

The history of WAE really begins in 1925 in Los Angeles. By virtue of the transcontinental service, San Francisco was in an advantageous position with direct air mail service to the east. It was easy therefore to persuade alert Southern California business men to invest in a service tapping the main line at Salt Lake. At the time the company's first air mail contract was received in July, 1925, Harris M. Hanshue became the company's first president. He began to assemble a pilot and operating organization, but lacking precedent, the business was not launched until the following April.

The new line met with instant approval, and in less than a month the company inaugurated a passenger service; other logical expansions followed quickly.

In December, 1927 WAE was awarded mail contracts between Cheyenne, Denver, Colorado Springs and Pueblo, the route afterwards being extended to Albuquerque and diverging there to El Paso and Amarillo.

At this juncture consideration was devoted to passenger business. From equipment loan funds made available by the Guggenheim Foundation and through the engineering ability of Anthony Fokker, the tri-motored Fokker F-10, ten-passenger plane was introduced in May, 1929. It carried two pilots, and initially operated between Los Angeles and San Francisco.

Other significant developments occurred almost simultaneously. Late in 1928 the government completed airway lighting between Los Angeles and Salt Lake and WAE instituted a night mail flight over the route.

The 22 observation stations and weather reporting facilities established by the company over its Salt Lake route from Los Angeles were supplemented about this time by developments in the radio

●

United's first mile was flown by L. D. Cuddeback in this Swallow mail plane on April 6, 1926, between Pasco, Wash., and Boise, Ida., on what is now the Pacific Northwest Division of United Air Lines

●

Ryan monoplane used to pioneer the Seattle-Los Angeles route

War-time de Havilland used over the midcontinental airway

telephone under the direction of Herbert Hoover, Jr. It was the first practical demonstration of a theory that since has become a vital factor in the dispatch of scheduled aircraft.

Western Air then began passenger service between Los Angeles and Kansas City, with air-rail connections to the east, and brought flight-mileage to 7,200 miles daily.

By March 1931, operations increased to 16,500 flight-miles daily over six routes. That year the company carried 31,000 passengers, representing approximately 25% of the nation's total.

General Motors, through its subsidiary, General Aviation, eventually purchased 60,000 shares of additional WAE treasury stock, advanced the company $1,000,000 and later consolidated this position with 51% control. Other General Aviation investments of the period were North American Aviation assets, which carried substantial interests in TAT-Maddux. This line also operated between Los Angeles and Kansas City, with a Pennsylvania Railroad tie-up for night transmission of passengers between Kansas City and the Atlantic seaboard.

However, with but one air mail contract forthcoming, it was advisable to effect an operating consolidation, and from this union the present TWA line emerged. Since other WAE operations and routes were not a part of this merger, the older company continued under its pioneer designation.

Following air mail contract cancellations of February, 1934, Western Air lost the Cheyenne-Denver-El Paso route in subsequent bidding and now operates its original airway from San Diego to Los Angeles and Salt Lake City. Later that year General Aviation sold its interests in WAE and also in TWA.

With advent of the present management under Alvin P. Adams, president, on January 1, 1935, the company aligned itself with the main line midcontinent route of United Air Lines. Today, Western Air operates the same multi-motored Boeing liners with which United pioneered high-speed passenger and mail service over the nation in 1933.

United Air Lines

One hundred million miles of flying is the international record which United Air Lines establishes next month, almost on its tenth anniversary. It was on April 6, 1926 that the first of United's 100,000,000 miles was flown, and ten years later to the day the company's total flying passed 97,000,000 miles and will reach its 100,000,000th mile early this June.

The first of the predecessor companies which were later joined to form United Air Lines was Varney Air Lines which inaugurated air mail service between Elko, Nev. and Pasco, Wash. via Boise, Idaho.

In response to the government's call for bids in 1925 on the spur northward from Elko, a stop on the transcontinental, a number of pilots and backers surveyed the route which had never been flown before. All but two decided the job was not possible. Those two were Walter T. Varney, for many years a flying school and charter service operator in California, and Leon D. Cuddeback, his chief pilot. They submitted a bid which was accepted.

The inaugural flight was made on April 6 under difficulties. Airplanes had been assembled during bad weather and a subsequent interruption of service after the inauguration was necessary to provide more adequate power-plants. Later the Post Office Department changed the route, making Salt Lake City the terminal instead of Elko, a much more logical point of departure from the main line route to the Pacific Northwest. Still later Varney's system was extended from Pasco to Portland, to Tacoma and Seattle and from Pasco to Spokane.

Meanwhile National Air Transport was organized on May 15, 1925 by Chicago and Detroit interests for the purpose of entering the air mail field. This company was the first private air mail group to be incorporated, although in actual operations service it was preceded by Varney and Western Air Express on the Salt Lake-Los Angeles route. National Air Transport, in competitive bidding, was awarded the contract for a line from Chicago to Fort Worth and Dallas via Kansas City and on May 12, 1926 with ten Carrier Pigeons and one deHavilland inaugurated its service.

The third of the predecessor companies of United Air Lines was Pacific Air Transport, organized in 1926. Pacific Air Transport was backed by Seattle, Tacoma and Portland capital and when the company was awarded the mail contract between Los Angeles and Seattle it created

(Continued on following page)

The old Douglas M-1 mail plane with which Western Air Express inaugurated its service on April 17, 1926

Western Air Express is now flying 10-passenger all-metal Boeing 247-D transports over its original route

In 1935, United Air Lines planes...world's greatest high speed transport fleet ...flew 6,000,000 dusk-to-dawn miles.

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MORE MILES OF SAFE LUBRICATION

(*Continued from preceding page*)

Loading the mail in a Colonial Western Fairchild FC2W at Buffalo, N. Y. in 1930

an airway that would require night flying as well as maintenance of schedules over a 1100-mile route. On September 15, 1926 Pacific Air Transport began operations. Varney and National Air Transport had restricted their operation to mail carriage only; Pacific Air Transport, however, carried passengers in open cockpits and two-place planes or in the mail pits of single cockpit ships.

The fourth, and last predecessor division of United Air Lines was set up early in 1927 as Boeing Air Transport. When the Post Office Department opened bids on the Chicago-San Francisco section of its transcontinental air mail route in February, 1927, Boeing Air Transport, headed by W. E. Boeing, Philip G. Johnson and Edward Hubbard, submitted a bid that won them the contract.

After the award, the Boeing Airplane Co. began construction of 24 new type Wasp-powered mail-passenger planes, the Boeing 40-B, a two-passenger, single-engined biplane with the pilot seated in an open cockpit to the rear.

In 150 days these planes were designed and constructed and on July 1, Boeing inaugurated service over the 2000-mile route between Chicago and San Francisco. Two months later National Air Transport, which had won the contract for the Chicago-New York portion of the transcontinental airway, began the first private operation of that route to mark the completion of the lines which had been drawn to form the background for United Air Lines. In 1931 these companies were brought together under the management of United Air Lines and following cancellation of air mail contracts the identities of the divisions were washed out to leave the one group, minus the Chicago-Kansas City division.

Head of the United Air Lines Transport Corp. (as United is officially known) is W. A. Patterson, whose direct and indirect experience with air transportation dates back to the pioneering days and who became president in 1933.

A review of United Air Lines record shows it has flown more miles, carried more passengers, mail and express than any airline in the world. It has been responsible for many advancements in passenger service, including the innovation of stewardesses as early as 1930.

The goal of United when it was consolidated was standardization of equipment and maintenance practices. At the time the four divisions were brought under one head each division was using different types of equipment, each had its own overhaul and repair base, its own system of flight control and its own service features and maintenance methods.

The first step toward unification of operations was the development of the P & W powered Boeing 247. By the summer of 1933 United had sixty of these planes in operation over its entire system and its other planes were grounded for disposal to private purchasers.

The second step came when divisional overhaul and maintenance bases were eliminated in favor of a central overhaul and repair base at Cheyenne, Wyoming. While principal United stations along its system were left with the responsibility of the 40- and 80-hour checks, all of the major engine and airplane overhaul work was allocated to Cheyenne. This effected economy and efficiency in operations, avoided needless duplication of facilities, and provided a generally more efficient and improved type of workmanship.

The next step in the consolidation of the operations of United Air Lines was setting up five geographically logical operating divisions in place of the old corporate division boundaries which had previously prevailed. These five divisions were created in 1934 as follows: Cleveland Division, New York to Chicago; Omaha Division, Chicago to Cheyenne; Salt Lake Division, Cheyenne to Oakland; Oakland Division, San Diego to Medford, Oregon; Portland Division, Pacific Northwest routes. Each division was placed under a division superintendent responsible to operations headquarters at Chicago and in direct charge of flight control over that division.

View of a Douglas DST, one of twenty now being built for American Airlines. The size of this new transport is shown in comparison with an Aeronca

American Airlines

It is hardly probable that the group of aviation enthusiasts who organized Bee Line, Inc., at Naugatuck, Connecticut in March 1923, foresaw that they were laying the foundation of a widespread system of airlines.

After a short time of operating as the Bee Line and doing charter and sight seeing work, the name was changed to Colonial Air Lines, Inc. Early in 1925, when the first Kelly Air Mail bill was passed by Congress, Colonial Air Lines, was awarded the first air mail contract (CAM No. 1) to carry the mail between Boston, Hartford and New York. Shortly thereafter the company merged with Eastern Air Transportation, Inc., and the name Colonial Air Transport, Inc., was adopted.

It was not until July 1, 1926 that the first air mail was flown out of Boston in a Fokker Universal plane, piloted by Talbot Freeman with Governor Trumbull of Connecticut as passenger, bound for Hartford and Hadley Field, N. J. (the New York terminus). Mail operations were carried on with two Fokker Universals and a Curtiss Lark, which kept to a schedule of a round trip every day until the airways were lighted, when the schedule was changed to a day trip and a night trip.

The first experimental scheduled night passenger service in the United States was inaugurated by Colonial between New York and Boston on April 1, 1927, using a tri-motored Fokker. The run was maintained for several months and proved the need for such a service, although it was not feasible to continue due to limited airport facilities.

For three years activity was confined to carrying mail, expanding with the formation of Canadian Colonial (FAM No. 1) the first foreign air mail contract to be awarded by the government, covering the route from New York to Montreal, and Colonial Western, flying out of

(*Continued on page 76*)

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Out of three years' continuous development has sprung this great new Fairchild "24," to out-perform even its distinguished predecessors—a plane easier to fly; smoother in landing or taking-off; stronger, sturdier; costing even less for upkeep.

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Always phenomenally easy to handle, control of the Fairchild "24" has been made still more effortless and positive by slightly altering the aileron design, tapering the wing tips sharply, and improving the operation of the flap control lever.

These and other features for 1936 render impressive the performance of the Fairchild "24"—establish it anew as the finest plane for the private owner that money can buy. Its lightning take-off, rapid climb, inherent balance, superb control at all speeds, have gained for the Fairchild "24" a world-wide recognition for being the one airplane that any pilot—regardless of age or experience—can fly with unequaled ease.

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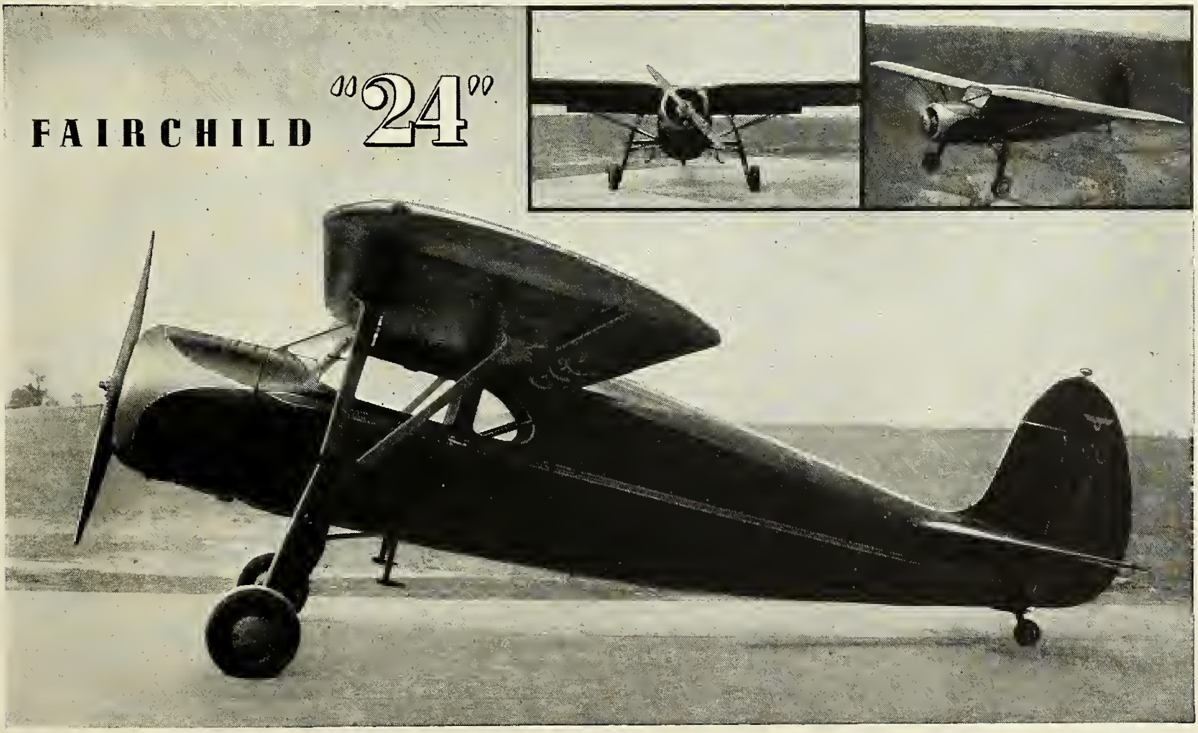

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● One of the difficult problems encountered in the use of dural for aircraft parts arises because surfaces are subject to corrosion unless protected by a suitable finish. Unfortunately, however, even the best finishes are subject to failure in time and in some atmospheres the failure may not be long delayed. This has been partly because, until quite recently, all applied finishes have been somewhat porous and, once moisture penetrates through the pores, corrosion starts and proceeds under the finish, which is ultimately loosened. Anodizing of the surface of the dural before other finishing helps to delay corrosion and also affords a good surface to which a finish will adhere, since the anodizing itself is porous, but neither anodizing nor an ordinary finish over it gives the desired protection.

This is quickly demonstrated in salt spray tests employing the usual 20% sodium chloride solution. Such tests, conducted in the laboratory of a large fabricator of dural parts in the New York area, show corrosion on anodized dural without other coating within 24 hours in the salt spray. Even the best of the ordinary finishes (a synthetic-resin varnish) yet tried failed to delay corrosion longer than 700 hours.

Efforts to secure better corrosion resistance led to tests of a comparatively new type of finish which is an outgrowth of a prolonged research carried on at the Massachusetts Institute of Technology in the quest for a coating that will form an impervious and non-porous film. This finish, or the vehicle which forms its base, is described as a "combination of pure vegetable gums and heat-treated oils made in a unique manner." It does not contain linseed oil, turpentine or synthetic resin. It is said, however, to produce a non-porous film which is not only water tight but impervious to atmospheric gases. Many different pigments, including those of the metallic and leafing type, are used in this vehicle with excellent results, not only as to impervious characteristics, but also in giving unusual adhesion and resistance to rapid changes of temperature between wide extremes.

Originally, this product was developed for finishing the galvanized cans or boxes employed in ice plants for holding the water which is converted into ice. These cans are subject to severe usage, going regularly through a cycle in which the temperature is reduced to about 0° F. to make the ice, after which the cans are removed and sprayed with hot water so that the cakes of ice can be removed. Finishes do not ordinarily adhere firmly to a galvanized surface. In this instance, however, the boxes have been in service for more than two years without requiring refinishing. As a result, Technical Coatings, Inc. was formed to make the finishes commercially and now is producing several, including those tested on duralumin.

Report on Anodized Dural

To date, tests have been made on both clear and pigmented finishes of this type and a report shows the following results, all of which apply to anodized dural with two coats of the finish applied by spraying:

All of the specimens were removed from the salt spray after 4,700 hours because, according to the report, at the end of this time (more than double the 2,000 hours required in Navy specifications) "there was no visible evidence of corrosion to the base metal." At the end of this test, the samples were subjected to the usual bend test over a mandrel of ¼-inch diameter, the sample having been coated all over. The following are among the observations in the report:

Aluminum mixing vehicle, without pigment (manufacturer's designation #1002). Sample darkened slightly because of aging, but bend test indicated high film elasticity and good adhesion to the base metal. No cracks visible at the bend.

Aluminum mixing vehicle (#1002) with aluminum powder mixed therein, as intended by manufacturer: No staining from condensation runs. Film elasticity and adhesion exceptional with no sign of cracking at the bend.

Clear coating (#1009). Sample darkened slightly. Coating became brittle and cracked under compression at bend, but adhesion fair.

Black coating (#2044). Color unchanged and of good appearance. Film elasticity fair but showed striations on compression at bend. Adhesion fair.

Coating containing aluminum and zinc (#2047). Surface stained badly as a result of condensation runs. Lacked elasticity and cracked at bend. Adhesion fair.

Coating containing metallic zinc (#2000). Surface badly stained and color changed considerably but coating had fair elasticity and adhesion.

Although there was no evidence of corrosion of the base metal on any of the samples, it is to be anticipated that, under service conditions, #1002 aluminum mixing vehicle and #1002 aluminum mixing vehicle with aluminum powder would be superior because of their exceptional elasticity and adhesion.

In justice to the new finishes it should be pointed out that, despite their excellent showing, none of the types tried were especially designed for use over dural, and further that the salt spray test, though generally used, imposes a much more severe set of conditions than is likely to be met in service. The #2000 type is that which proved so useful on the ice cans, as well as in many other applications, especially around salt water. Though discoloration results, this is true of many finishes in salt spray. This type of finish is designed, however, particularly for use on galvanized and on black steel where conditions are severe. For fresh water applications and severe weathering on steel, the #2047 aluminum-zinc has proved excellent.

In the case of the clear vehicle for aluminum, this was designed for use with aluminum powder (about 25% less than is commonly employed) to be mixed just before application. Since the tests reported above were made, a ready-mixed aluminum, which is free from tarnishing in the can, has been developed and is expected to give still better results in the salt spray.

Although the report indicates that an aluminum finish is undoubtedly the type best suited for use over dural, the makers of the finishes described state that, according to their practical experience in this field, under conditions of every-day wear and tear, best results are secured by using a prime coat #2047 (the aluminum-zinc type), followed by a top coat of #2001 ready-mixed aluminum, which is made with the impervious vehicle employed in all the finishes they produce.

Pratt & Whitney Twin Row Engine Delivers 1160 hp at 2700 rpm

● The most powerful radial air-cooled aircraft engine yet announced, is the new Pratt & Whitney Model 1830 Twin Wasp rated at 1000 hp at 2400 rpm, and capable of delivering 1160 hp at 2700 rpm. It weighs 1250 lbs., equal to a weight of 1.25 lbs. per hp at 1000 hp, and 1.09 lbs. at maximum output. The latter figure is the lowest weight/hp as yet achieved by any aircraft engine in production.

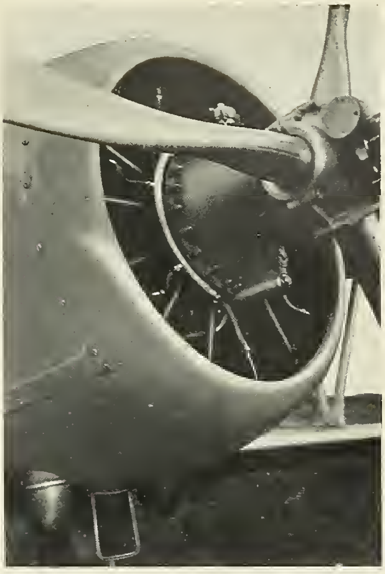
Among the features of the new engine are complete automatic valve gear lubrication, automatic mixture control, enlarged cylinder head cooling fins and a new pressure baffling system which increases cooling efficiency and lowers fuel consumption. Tests on fuel consumption show .45 lb./bhp/hr.

The system of valve lubrication circulates continuously engine oil under pressure through the valve mechanism, requiring no manipulation by the pilot or ground crew. As a result, it has been possible to extend the time between valve checks from the former period of 20 hours to a minimum of 80 hours and in some operations as much as 100 hours.

The automatic mixture control gives positive control of fuel ratio and power output for three operating conditions under the control of the pilot. The control is set for take-off allowing full throttle and full rich mixture. Immediately after the take-off it can be set for climbing at rated power with a moderately rich mixture. When cruising altitude is reached the control is switched to cruising position which limits the power to a predetermined amount required for cruising and the fuel consumption to an economical minimum. From this point until the completion of the flight no further attention is required regardless of changes in altitude.

Cylinder head design consists of rocker boxes cast integral with the head and deep, thin, closely spaced cooling fins. The pressure baffles are deflectors between the two rows of seven cylinders each, which blank off the free flow of air over the engine, directing it between the fins so that all air which is passed around the cylinders is utilized for maximum cooling. The principle is based on the pressure built up at the front of the engine by the forward speed of the airplane with a lower pressure created behind the engine by the venturi effect of the cowl resulting in drawing the air at high speed through the cooling fins.

Since the ascendency, in the early 1920s, of the radial air-cooled power unit both for military and commercial aircraft the requirements for power have increased. Previously, in response to the demands of the aircraft operator and manufacturer it was possible to step up engine power through the addition of internal supercharging, by increasing compression ratios, strengthening parts, permitting higher rpm, and by using fuel with high octane rating. The resultant power increase was and is dependable. But there is a definite limit beyond which further development is not regarded as practical, nor safe nor economical.



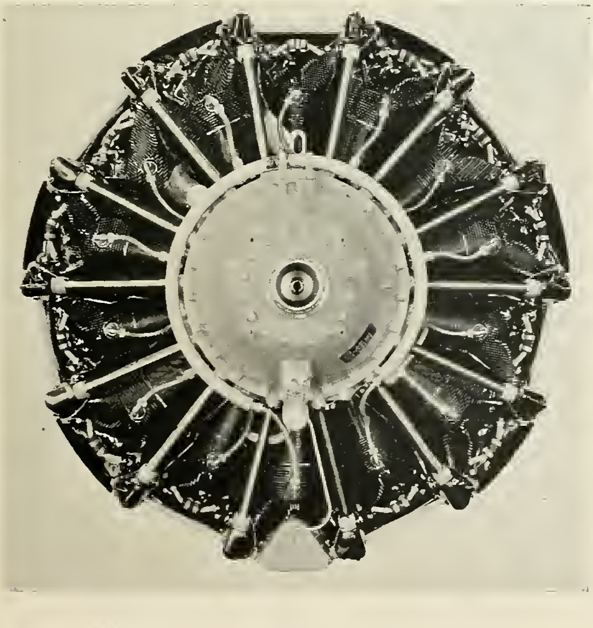
Aero Digest Photo

Test installation of the P&W Model 1830 Twin Wasp in a Vought Corsair military plane

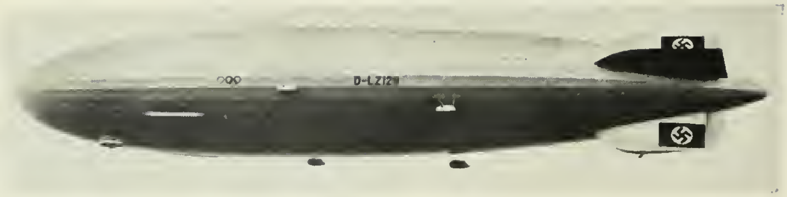
One of the answers to the situation as it exists today is relatively simple. Theoretically by putting two single row engines of proved quality together there results a power unit of much higher performance—the two row engine—and through its development and perfection high hp requirements may be met. Seven years ago Pratt & Whitney began to experiment with the two row design to supplement the single row. Its work on this project and the subsequent perfection of two engines, one with 1535 cu. in. displacement (the Twin Wasp Jr.) and the other with a displacement of 1830 cu. in. (the Twin Wasp) are examples of their progress in this field.

The advantages of multi-cylinder power plants are greater for aircraft than for automobiles, where there is ample evidence of the replacement of the four- and six-cylinder engines with six- and eight-cylinder engines respectively. The smaller, more frequent power impulses provide smoother operation and longer life. In the Twin Wasp there are 250 impulses per second from a 5.5 in. cylinder at cruising horsepower, and in the highest power nine-cylinder single row engine there are 130 heavier explosions per second from a 6.25 in. cylinder. The use of smaller cylinders permits higher crank speed, further contributing to smoothness of operation.

The combination of high crank speeds with comparatively small cylinders permits a greater mean effective pressure with any given fuel; therefore more power for a given displacement can be obtained. This means higher power for take-off, emergency operation and for regular cruising.



Front view of the newest Pratt & Whitney two-row radial engine, the model 1830 Twin Wasp



"Hindenburg", Latest and Largest Zeppelin Airship

● Trans-Atlantic dirigible service between Germany and the United States got underway this month when the new LZ 129, named the *Hindenburg,* made its inaugural flight between these countries. The take-off was made from Friedrichshafen and the landing at the Naval Air Station in Lakehurst, N. J. where connections to other parts of the United States are made by a connecting service operated by American Airlines.

Structurally, the design of the ship follows recent LZ types, the ship being basically similar to the *Graf Zeppelin,* although incorporating improvements and refinements in design. The system of main rings, intermediate rings, longitudinals, lower and central corridors is essentially the same, with the *Hindenburg* being divided into 16 bags, in each of which is a separate gas cell.

There are 36 longitudinal members, and main rings are of the flat, wire-braced type. Girders are of the triangular trussed type, utilizing aluminum alloy of recent development which results in high weight/strength ratios representing an advance in airship girder design over previous types.

Two main corridors extend through the ship, one at the bottom, (the main load-carrying unit, along which are located fuel and water tanks, supplies, crews quarters, etc.) and the other, extending through the center, fore and aft, from bow to stern. The lower corridor accommodates all traffic through the ship, while the central, or axial corridor, in addition to being a primary stress member, serves for gas cell inspection purposes. The axial corridor is accessible by three ladders from the lower corridor and may also be entered from the bow where the lower corridor also terminates.

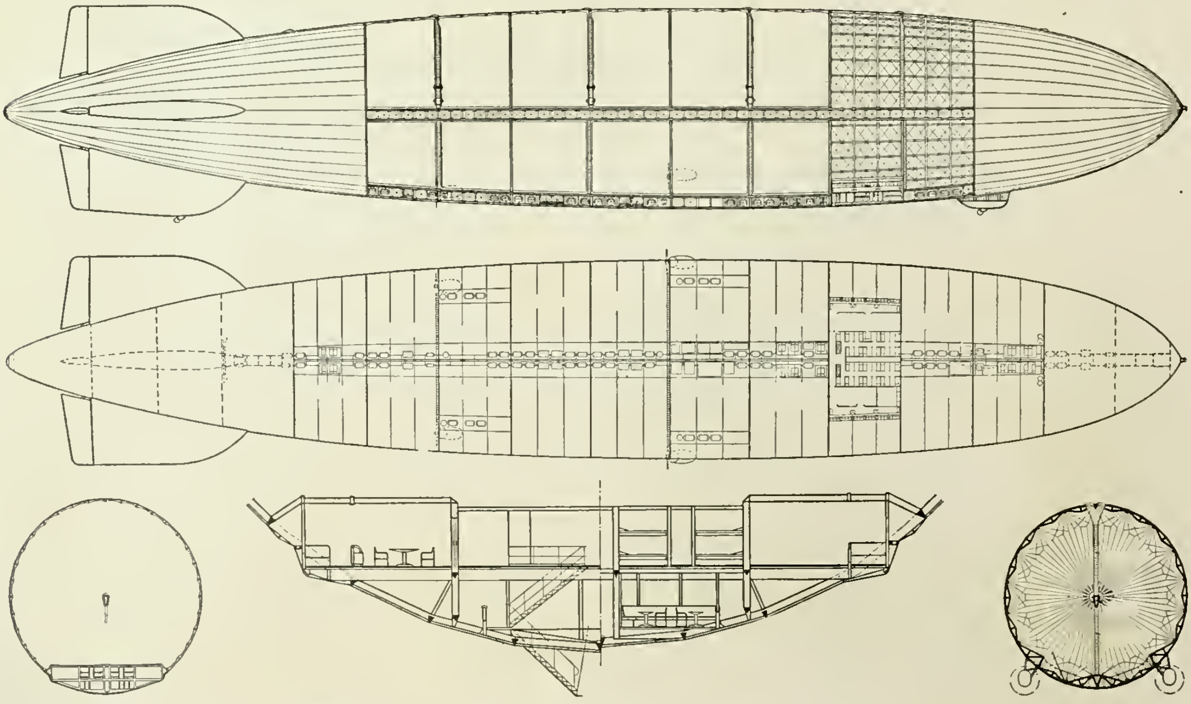
The control car is forward of the passenger quarters; its size has been held to a minimum with no accommodations for passengers.

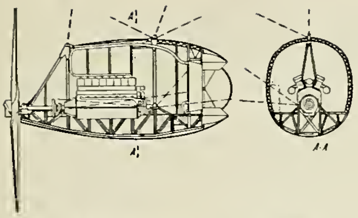
Horizontal and vertical control of the ship is normally by hand through a system of gears and cables running to the control surfaces. It is possible to clutch in an electric motor and drive, to replace man power. The elevator or rudder man can then control the ship by switching the motor in or out in the desired direction of rotation. Hand control can be regained by declutching the drive.

The 16 gas cells are constructed with a tunnel extending through the central corridor runs. The cells are equipped with maneuvering valves (which may be operated from the control car) and automatic valves which operate only when the cell is completely inflated. Maneuvering valves can be operated simultaneously by a hand wheel or individually by toggles. Valves are located above the central corridor in the bulkheads between cells, with gas ducts to carry the valved gas up to the top of the ship, where hooded openings in the covering are provided for its escape.

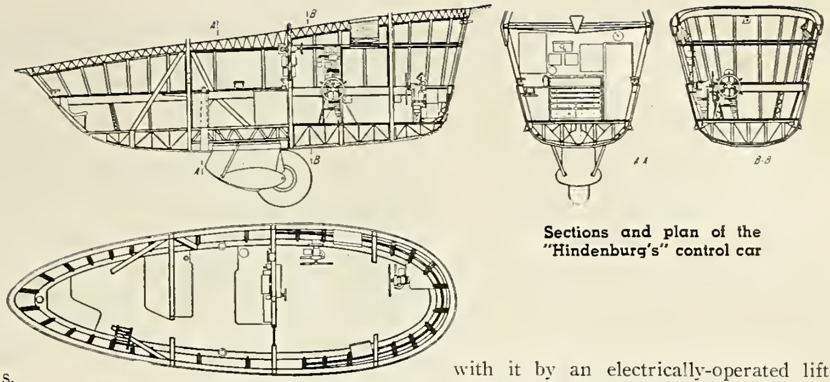
Quarters, provided along the lower corridor for a crew of 46, are divided into three groups; quarters for 12 officers are above the control car forward of the passenger quarters; deck force quarters with accommodations for 22 are aft of the passenger quarters; while the machinist's quarters with 12 bunks are aft near the power plants.

Electric power is generated in a central plant located in a fireproof room along the lower corridor, power being derived from two 50 hp Diesel engines, each driving a 33 kw generator delivering 220 volts.


Sectional views of the trans-Atlantic Zeppelin LZ 129 airship "Hindenburg"



Sectional views of one of the four engine nacelles



Sections and plan of the "Hindenburg's" control car

A telephone system, with 14 stations, connects vital points of the ship with the central station in the control car. The control car and the four power cars have a mechanical telegraph system. Commands are shown on an indicator in the control car, and through a system of cables the commands are similarly indicated in each power car.

Landing shocks are taken by two large pneumatic Goodyear tires, mounted on turntables, so that they can swing in any desired direction. In addition, the wheels are retractable, being enclosed in a stream-lined cowling.

Passenger quarters, arranged to accommodate 50 persons, are confined to one bay entirely within the ship's hull and constructed on two levels. Included in these quarters are 25 staterooms, each with two berths; four public rooms including dining room, lounge, writing room and smoking room; promenades, kitchen, officers and crew's mess rooms, bar, bath and lavatories.

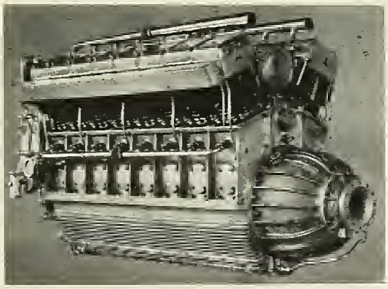
Cabins are located in the inner portion of the quarters without outside exposure and are artificially lighted. Cabin furnishings include a washstand with mirror and hot and cold running water, writing ledge, chair, and clothes closet. Basins fold flush with the wall when not in use.

Ample visibility is provided by windows along the promenades on both sides. These windows, at an angle providing wide range of vision, are provided for both decks, upper and lower. In addition, a hot air system insures heat under all conditions.

Entrance to the smoking room, on the lower deck, is gained through a swinging door designed to form an airlock, thus minimizing fire hazard. This room is attractively decorated and furnished with upholstered seats and chairs and with tables for serving refreshments from the adjoining bar. Windows along one side provide light and an outside view.

Cooking in the kitchen is done electrically. Built-in electric refrigerators provide cold storage space for meats and other perishables.

The dining room, seating 34 people at about ten tables, is the largest room in the quarters. Adjoining is a steward's pantry, over the kitchen and connected with it by an electrically-operated lift.



Mercedes-Benz 1200 hp Diesel engine

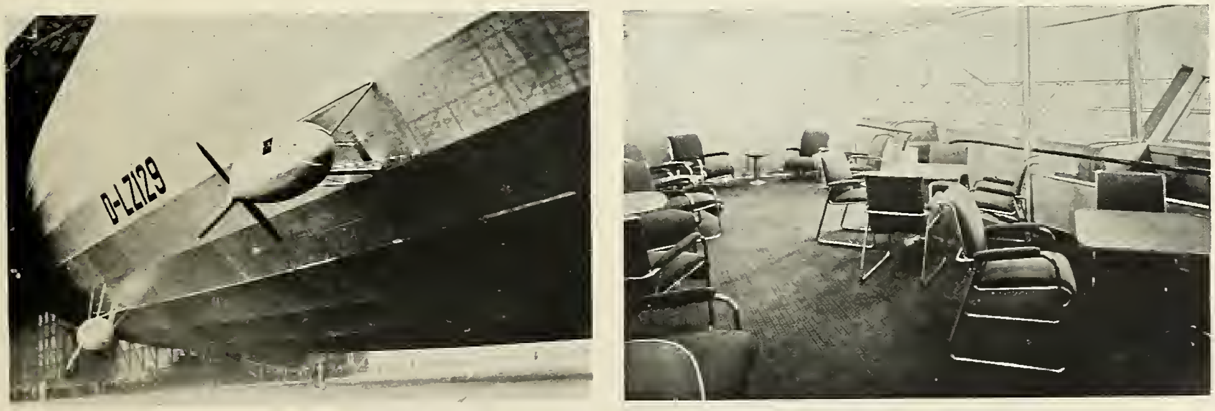
In contrast to the Graf, which was equipped with five 450 hp Maybach gasoline engines, the *Hindenburg* is equipped with four Diesel engines. Three of the best known German engine manufacturers occupied themselves with the solution of the power problem of the ship with Daimler-Benz receiving the award for their Mercedes-Benz LOF-6 engines.

In the final specifications of the order, a cruising output of 800-900 hp at a fuel consumption of not more than .396 lb./hp/hr. was decided upon. The engine allows a maximum output of 1200 hp, at which fuel consumption still remains below the guaranteed figure. The engine is the Vee type, with two banks of 8 cylinders each, having roller bearings for the connecting rods on the crankshaft.

The upper and lower engine casing is of Silumin-Gamma, and the crankcase bottom is provided with cooling fins. The crankshaft is carried in nine bearings, is equipped with counterweights, and hardened bearing surfaces. The pre-combustion chamber is located in the center of the water-cooled steel cylinders, each cylinder being provided with two inlet and two exhaust valves. Cylinder heads are covered with a valve gear housing, and pistons are made of EC-124 alloy carrying a Niresist insert.

On account of possible inclination of the engines, two suction pumps are pro-

(Continued on page 78)



Starboard side of the "Hindenburg" and an interior view showing its passenger lounge

Warner-Powered Fairchild "24"

● Fairchild Aircraft Corp., has brought to the private owner field a new and improved three-place cabin "24" with which it will make its bid for 1936 business in this class.

In appearance and design, the 1936 Fairchild "24" presents a number of new features—the newly designed NACA cowl, sloping windshield, altered landing gear and a cantilever tail supporting the manufacturer's contention that the new model incorporates refinements intended to increase performance and comfort.

Construction follows standard Fairchild practice, with a fabric covered fuselage of welded steel tubing, treated with a sand-blasted aluminumized-oxide process. The fabric covered wing, which has spruce spars and truss spruce ribs has a more pronounced taper to the tips. The tail group is of welded steel and wood with plywood and fabric covering and rudder horns have been faired and concealed. Fittings are cadmium-plated or anodized and moveable parts of the plane are provided with ball-bearing mounted bushings.

In the interior there is more head and leg room for the passenger in the rear seat. Appointments have been improved by the use of Tenite hardware which blends with the interior finish. The shock-insulated instrument panel, finished in a polychromatic brownish gray, has new lines and incorporates a flush-type ash tray. Improvements extend also to the map and glove compartment which is now provided with a self-closing door. Further improvements in the interior include a pilot seat with one-hand adjustment, new type brake pedals, and concealed zippers which allow removal of the head lining for inspection of controls.

The vertical firewall has a circular section at this point, thus producing a gain in aerodynamical characteristics and providing greater depth to the instrument panel for easy access.

The windshield has a greater slope which not only increases visibility in flight, but also adds gracefulness to the lines of the plane.

Fewer parts are used in the control system which is now provided with ball bearings mounted on standard forgings. Removable floor boards permit access to the control for adjustment or repair.

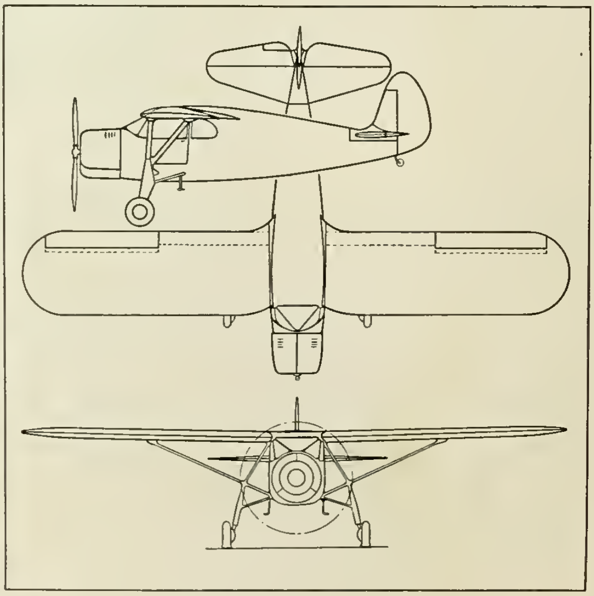
Ailerons are operated through push and pull tubes, and are statically and aerodynamically balanced. They are provided with a slot-arrangement which intensifies the airflow across their surface at high angles of attack.

Flaps have a chord of 10 inches and are of the split-balanced type being operated by a control lever in the cabin. In the 1936 model, they have been reinforced and stiffened. Operating mechanism units have been minimized, hinges are streamlined and the operating lever has been relocated for greater convenience.

The new cantilever stabilizer is of good aerodynamic form and is rigidly fixed to the fuselage structure. Better and cleaner fairing has been incorporated between it and the fuselage. The Fairchild "24" also incorporates a double tab control on the elevators for adjustment of balance or trim.

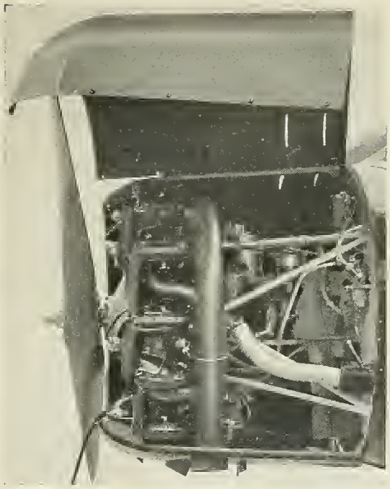
The landing gear has a tread of 9 ft. 3 in. Angular movement of the wheels has been eliminated, and up and down travel (10 in.) is now vertical, thus eliminating tire side wear on hard runways. Tires are

Side, front and outline plans of the Fairchild "24"



6.50 × 10 Goodrich with an 8" streamline Goodyear on the tail wheel. Longer oleo travel has been provided and tapered axle and bearings are used. Brakes are of Warner manufacture and are self-energizing.

The new smooth type engine cowl (which extends to the firewall) gives greater efficiency to cooling. Installed in three sections, the two side sections are hinged on the center line permitting either side to be opened independently. For engine overhauls the entire unit can be rapidly removed by merely loosening the Dzus fasteners, and when the cowl is open the entire engine compartment is accessible.


Cowl of the Fairchild "24" lifted for inspection of the engine

Through cooperation with the engine manufacturer the 145 hp Warner Super Scarab engine which is an alternate with the Fairchild Ranger in-line as power plants for the "24," has also been improved. It now incorporates a stronger and better balanced crankshaft, non-projecting carburetor mounted within the engine cowl and an improved induction housing. The air intake is mounted on the side of the cowl and carburetor air intake temperature is controllable. A single exhaust outlet for all cylinders has resulted in reduction of noises. In addition, a strainer drain, operated from the cabin, has been incorporated in the fuel system.

Specifications of the Fairchild "24" for 1936 with the 145 hp Warner Super Scarab engine are as follows:

Specifications

Wing span	36 feet 4 inches
Length overall	23 feet 9 inches
Height overall	7 feet 3 inches
Empty weight	1465 pounds
Useful load	935 pounds
Gross weight	2400 pounds
Baggage	100 pounds
Fuel	40 gallons
Oil	3 gallons
Maximum speed (sea level)	134 m.p.h.
Cruising speed at 8000 ft.	124 m.p.h.
Cruising speed at 5000 ft.	122 m.p.h.
Cruising speed at 3000 ft.	118 m.p.h.
Cruising speed at sea level	116 m.p.h.
Rate of climb	750 ft./min.
Service ceiling	19,500 feet
Cruising range	500 miles

Recent Aeronautical Patents

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● The following patents of interest to readers of Aero Digest recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Variable pitch propeller. Raymond P. Lansing, Montclair, and Romeo M. Nardone, East Orange, N. J., assignors to Eclipse Aviation Corp. (2,033,342)

Aircraft having freely rotative-sustaining means. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (2,033,571)

Aircraft brake. Lewis J. Tetlow, Holyoke, Mass. (2,033,659)

Gunner compartment. Drew M. Helivig, Overlea, Md., assignor to the Glenn L. Martin Company, Baltimore, Md. (2,033,768)

Landing gear. Arthur G. Butler, Eggersville, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,034,083)

Two-speed supercharger drive. Roland Chilton, Ridgewood, N. J., assignor to Reed Propeller Co. (2,034,087)

Hand grip and cover (for airfoils). Chas. E. Hathborn, Kenmore, N. Y., assignor to Curtiss Aeroplane & Motor Co., Inc. (2,034,095)

Retractable landing gear. Guy A. Luburg, Snyder, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,034,106)

Parking brake (for aircraft). Robert A. Swalm, Buffalo, N. Y., assignor to Curtiss Aeroplane and Motor Co., Inc. (2,034,121)

Airplane heater. David Gregg, Caldwell, N. J., assignor to Eclipse Aviation Corp. (2,034,140)

System for charging internal combustion engines. Martin A. Lauret, Neuilly-sur-Seine, France, assignor to Bendix Aviation Corp. (2,034,144)

Lateral control for airplanes. Fred E. Weick and Joseph A. Shortal, Hampton, Va. (2,034,218)

Power transmitting device (suitable for aircraft). Harry Williams, Birmingham, Michigan, assignor to American Cable Co., Inc. (2,034,219)

Machine gun mounting for aircraft. George W. Brady, Anderson, Ind. (2,034,223)

Radio receiver arrangement for landing aircraft. August Leib, Berlin, Germany, assignor to Telefunken Geseleschaft fur Drahtlose Telegraphic m.b.H., a corporation of Germany. (2,034,520)

Lifting device for aircraft. Archibald M. King, Chicago, Ill. (2,034,761)

Universally balanced aircraft indicator. Paul Kollsman, Woodhaven, N. Y. (2,034,909)

Cooling means. Robert R. Osborn, Kenmore, Pa., assignor to Curtiss Aeroplane & Motor Co. (2,035,019)

Streamer adapted for towing by aircraft. Charles D. Young, Haverford, Pa., assignor to Kellett Autogiro Corp., Philadelphia, Pa. (2,035,038)

Aeronautical wheel. Robert J. McLaughlin, Brooklyn, N. Y. (2,035,175)

Aircraft float light or smoke bomb. Harry J. Nichols, Dayton, Ohio. (2,035,185)

Parking harness. George F. Haberstro, Jr., Buffalo, N. Y., assignor to Curtiss Aeroplane & Motor Co. (2,035,231)

Means for absorbing the energy of a falling body (relates to a flare). William A. Gibson, Succasunna, N. J. (2,035,367)

Airplane kite. Arthur H. Trevor, Seattle, Wash. (2,035,730)

Automatic rip-cord timer. Edward T. Barron, Minneapolis, Minn. (2,035,779)

Aircraft. Carl A. Barrett, Chicago, Ill. (2,036,011)

Rotary internal combustion engine. Newton A. Lewis, White Plains, N. Y. (2,036,060)

Interchangeable unit camera, also camera positioning device. Frederick W. Lutz, Garden City, N. Y., assignor to Fairchild Aerial Camera Corp., Woodside, N. Y. (2,036,061 and 2,036,062)

Gyroscopic navigation instrument. Douglas G. K. Moss, Sunderstead, England. (2,036,229)

Frame for internal combustion engines. Roscoe F. Good, U. S. Navy. (2,036,269)

Auxiliary parachute. John M. King, Dover, N. J. (2,036,279)

Gyroscope sextant. Scott B. MacFarlane and Robert E. Jasperson, U. S. Navy. (2,036,288)

Projectile. Wiley T. Moore, Wright Field, Dayton, O. (2,036,292)

Flexible shaft (suitable for controls). Elmer G. Kesling, Bloomfield, Mo. (2,036,528)

Passenger chair for airplanes. James H. Kindelberger, Los Angeles, and Arthur E. Raymond, Santa Monica, Calif., assignors to Douglas Aircraft Co. (2,036,529)

Level flight indicator. Paul Kollsman, Woodhaven, N. Y. (2,036,581)

Fuel gauge. Paul Kollsman, Woodhaven, N. Y. (2,036,582)

Aircraft. Hakon G. Lind, New York, N. Y. (2,036,587)

Airship speed indicator. Gaspare Mezzatesta, New York, N. Y. (2,036,879)

Airplane wing. Ray G. Sline, San Diego, Calif. (2,036,891)

Airplane wing. Fred E. Weick and Millard J. Bamber, Hampton, Va. (2,036,905)

Gyroscopic apparatus. John P. Brown, South Croydon, England, assignor to P. B. Deviator Ltd., London, England. (2,036,914)

Digest of Technical Articles from Foreign Publications

Aerodynamics

Sailplanes CAGT-1 and CAGT-2 in the Light of the Tailless Sailplane Problem, by Ing. A. F. Tourchicoff, The Technique of the Air Fleet, U.S.S.R. No. 12, December, 1935.

After a fairly extensive historic review of the problem of tailless type of design, the author summarizes the salient points of the lessons to be derived from accumulated past experience. In his opinion, the degree of sweep or taper are of secondary importance and fully subordinate to a judicious selection of airfoil profiles along the span of the wing. This selection must be also made with a view of obtaining a proper degree of aerodynamic twist, which, in proper correlation with a suitable center of gravity location, provides the desired degree of stability. As regards the control, the standard three-type control is to be preferred. The article contains a description of both sailplanes with the results of considerable wind tunnel investigations including longitudinal, lateral and directional stability and control. In addition, the author includes aerodynamic investigation of twisted tapered airfoils and particularly the determination of moments for stability calculation. The article concludes with the results obtained during flight tests and at soaring meeting trials.

Structural Analysis

New and General Method of Strength Calculation of a Variety of Wing Structures (Nuovo e Generale Metodo di Calcolo per una Vasta Categoria di Strutture Alare, Carlo Minelli, L'Aerotecnia, Volume XVL-N. 2, Febbraio 1936).

The article is divided into three parts, the first treating the case of a cantilever wing with two beams and ribs; the second introducing the effect of external concentrated bending and torsional moments and the third analyzes the effect of double drag bracing or covering. The author determines first the bending moments in the two beams making use of the three moment equation. Next the equations are extended to take into account the bending and torsional moments concentrated at any three sections of the original structure. This extension enables to account for the effect of the bracing in the plane of the wing as well as any restrictive structure such as *N*-brace for the case of a cantilever biplanes. From the analysis of equilibrium of the structure and deformations new equations are arrived at which include the effect of supplementary moments. The final equations are thus based on the ultimate conditions assuring elastic equilibrium of the whole structure. The article includes three numerical examples to illustrate practical application of the method.

Trimming Tabs

Elevator Trimming Tabs, a Graphical Method for their Design Derived From Actual Tunnel Results, G. V. Lachmann, A.F.R. Ae.S., Dipl. Eng. and R. S. Stafford, A.F.R. Ae. S., Aircraft Engineering Vol. VIII, No. 85, March 1936.

The article treats the quantitative phase of trimmer tab design outlining a simple graphical method which enables correct determination of stability and control characteristics. The question of proper setting and of the angular range is arrived at from wind tunnel tests by a sequence of graphical plots. This method has an advantage of visual representation of numerous variables which enter into the problem and obviates certain generalities inherent to the theoretical treatment of the problem. It is of particular importance that the digrams thus arrived at indicate the limit of static stability in conjunction with the limitations presented by the use of trimmer tabs.

Note on Boundary Layer Flow, by H. B. Squire, M.A., Air Ministry (Great Britain) Aeronautical Research Committee Reports and Memoranda No. 1664. *13th February,* 1935.

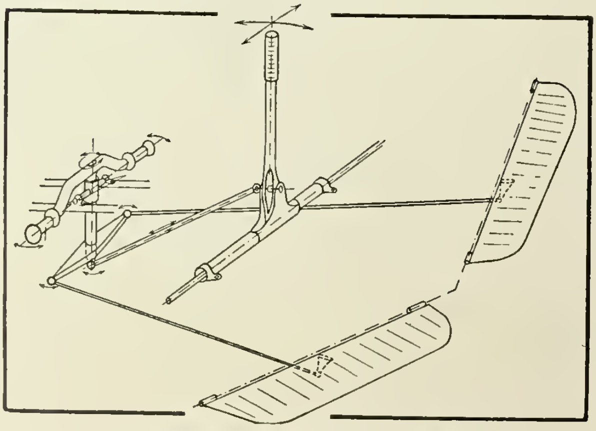
The report gives the following summary of the contents:

A simple account of recent development in boundary layer theory was required which could be related to the practical aerodynamic problems in hand. In this note the flow along a flat plate and the effect of pressure gradient on the transition of the boundary layer from laminar to turbulent and on breakaway are reviewed. Finally modern theories of the effect of turbulence and variation of R. N. on maximum lift are considered.

Rolling

Experimental investigation of rolling stability of airplanes (Etude expérimentale sur la stabilitê transversale des avions, par Emile Duchêne, Publications Scientifiques et Techniques du Ministerè de l'Air).

After a general discussion on definitions, conventions and signs, the author describes in detail the models and apparatus used in these tests. The tests proper include results on models without wings, wing alone, model complete—low wing without dihedral, high wing without dihedral, low wing model with dihedral and high wing model with cathedral. Tests covered the effects of dissemitry and problem of autorotation. In connection with the latter the author describes a phenomena of rotary oscillations which he calls autooscillations and which was observed whenever the axis of autorotation did not coincide with the direction of the relative wind. The paper stresses the points of practical limitations presented by the nature of apparatus used in these tests allowing freedom of rotation of the models only about one definitely fixed axis.



Bleriot control linkage for Vee type tail surfaces

Propellers

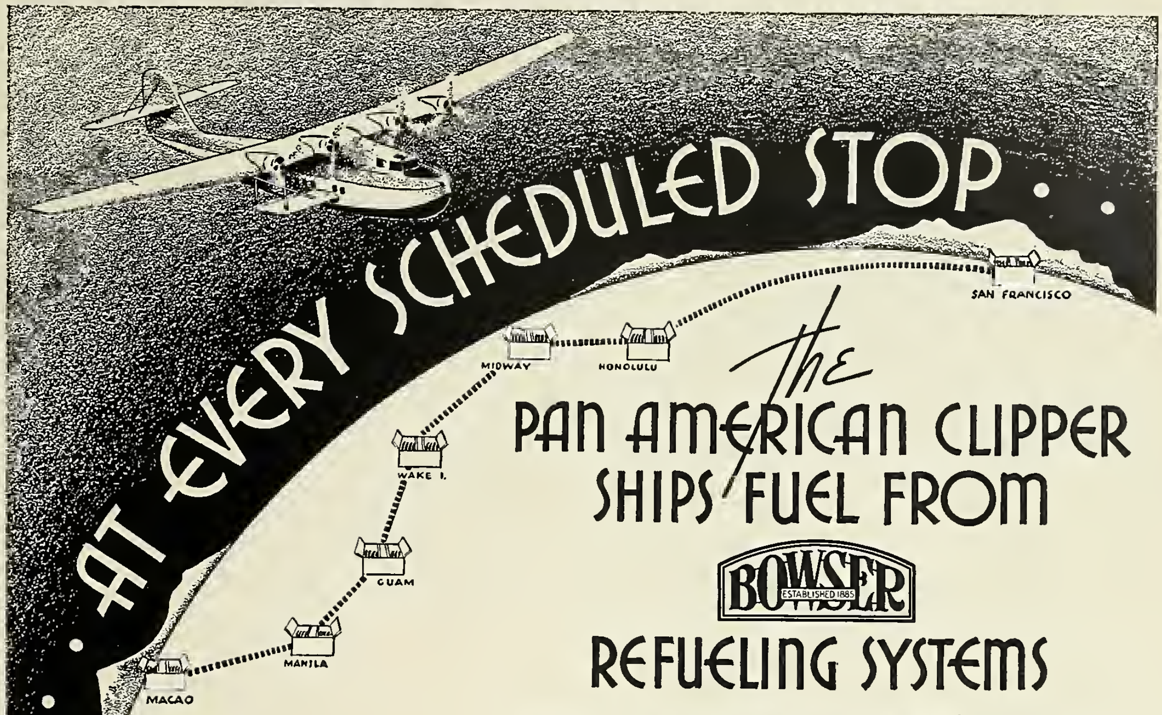
Wind Tunnel Tests of High Pitch Airscrews.—By C. N. H. Lock, M.A., H. Bateman, B.Sc., and H. L. Nixon of the Aerodynamics Department, N.P.L. Air Ministry (Great Britain) Aeronautical Research Committee. Reports and Memoranda No. 1673, October 5, 1934.

This report presents the extension of the tests on the original family of propellers of 3 ft. diameter (R. & M. 829). The pitch diameter ratios of the principal series of propellers (two- and four-bladers) in these tests were 0.3, 0.5, 0.7, 1.0 and 1.5, this range having been considered adequate at the time to cover all practical requirements. After a lapse of 12 years, however, the pitch diameter ratios of full scale propellers have increased almost to the limit of these tests and extreme values of 2.2 have been used. It was decided, therefore, that a further series of propellers should be tested to extend the range of pitch values to 2.5. This report includes additional tests made with the blades of *P/D* 1.5 rotated to the equivalent pitch values 1.0, 1.25, 1.8, 2.2 and 2.5. Some of the tests on the low pitch propellers were made in a closed 7 ft. tunnel, but the tests of the highest pitch propellers were made in the new open jet tunnel in order to use the higher maximum tunnel speed. Thus a comparison was obtained between observations in the closed and open jet tunnels for a number of propellers and these support the standard methods of correction for tunnel interference.

Design

Two Test of Vee Type Tail Surfaces (Deux Essais d'Empennages en V, L'Aérophile, Mars 1936).

The article compares the results of wind tunnel tests on two models of low wing Mauboussin airplanes. Tests of standard tail surfaces and a single horizontal tail with 30° dihedral lead to the following conclusions: An increase of from 3.4 to 6.7% in maximum lift, an increase of from 8.2 to 3% in fineness, negligible change in minimum drag, slight decrease in longitudinal stability, general improvement in maneuverability with marked improvement however in degree of stability at high angles of attack, slight decrease in directional control at small angles of attack but a considerably better directional control at high angles of attack. A set of flight tests gave very satisfactory results. The article includes two types of control linkage proposed for the use with this type of tail arrangement with detailed explanation of the action of different parts.



the PAN AMERICAN CLIPPER SHIPS FUEL FROM

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ESTABLISHED 1885

REFUELING SYSTEMS

Pioneers! On their heels comes progress!

From the inception of the first small air line, Bowser—the original and pioneer manufacturer of Aircraft Refueling Systems—has worked closely with Pan American Airways, Western Airways, United Air Lines and other prominent pioneer operators, at home and abroad, in developing efficient refueling systems to assure safety, dependability, accuracy, and water-free fuel.

In pioneering the Pacific, it was natural that Pan American Airways, with its fine reputation for safety and care in airline operation, should *again* choose *Bowser High-Speed Systems* to reduce refueling time at scheduled stops to a minimum.

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- Underground Systems
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There's a Type and Size to Meet It!

JUNIOR XACTOMETERS

For Checking Engine Fuel Consumption

Extremely accurate measurement of engine fuel consumption during flight is made possible by Junior Xacto Meter. Instrument panel dial, electrically operated, records in 1/100 gallons to 10,000 and repeats.

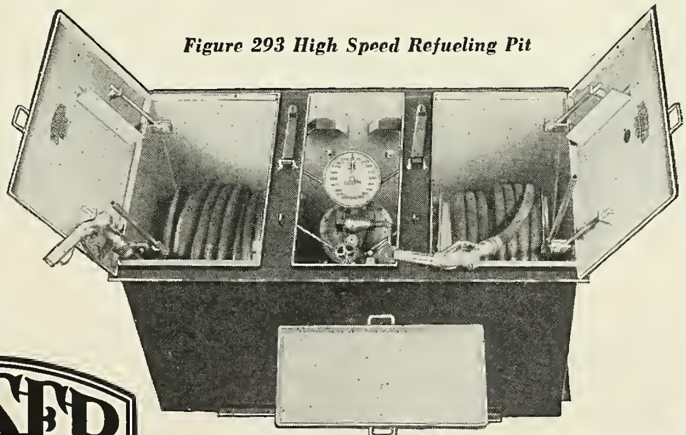

Figure 293 High Speed Refueling Pit

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SPECIALISTS IN AIRCRAFT REFUELING SYSTEMS . . .

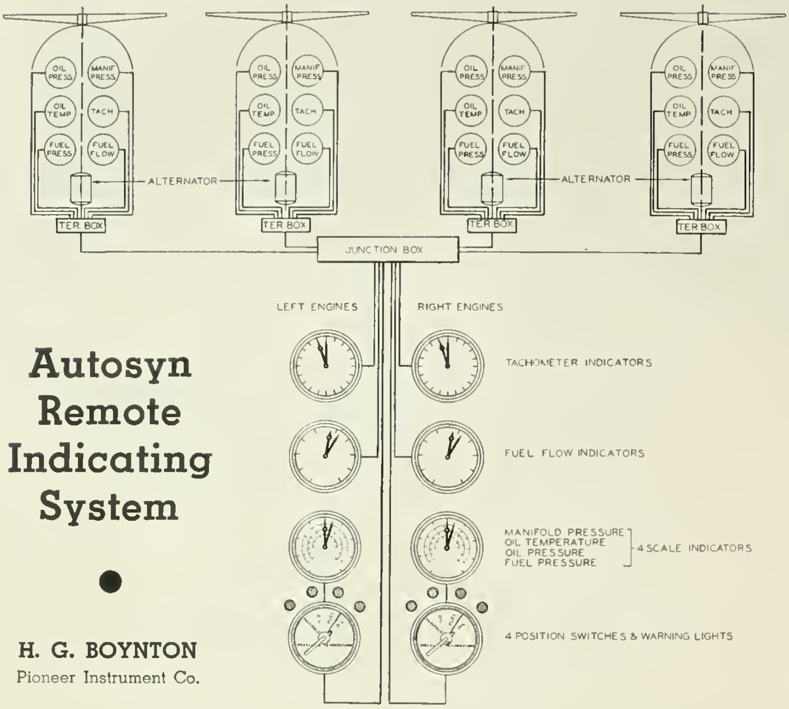
S. F. BOWSER & COMPANY, INC.

FORT WAYNE, INDIANA, U. S. A.

Autosyn Remote Indicating System

●

H. G. BOYNTON
Pioneer Instrument Co.



● The increasing size of transport and military aircraft has created a need for a simple and reliable remote indicating system for engine instruments and the indication of the position of the retractable landing gears, flaps, bomb doors, etc. The advantages of such a system are briefly, that it will eliminate running tachometer shafts, oil and fuel lines, thermometer capillary tubes and other pressure lines to the cockpit and will facilitate service as the only connection between the transmitting and indicating unit is an electric conductor.

The Autosyn motor which becomes both the transmitting and indicating unit in the Autosyn system is a small self-synchronous motor developed in the laboratories of the Pioneer Instrument Co. It measures 2⅜" in diameter × 2⅜" long, and weighs 10 oz. Self-synchronous motors as a class have proven their reliability by more than a decade of use in marine and power plant signaling systems, and the Autosyn being the smallest and lightest self-synchronous motor manufactured is particularly adaptable to aircraft use. Its characteristics show a .16 amp. current, 32 volts AC-60 cycle or 110 volts AC-800 cycle, 2-watt power, 15° C. heat rise, 40 grams Cent. peak torque.

The stator of the Autosyn motor consists of a closed three-phase winding impregnated and baked with a moisture- and oil-resistant varnish. A bipolar rotor of the salient pole type carries a simple field winding. On transmitting motors, one end of the field circuit is connected to a spiral lead-in wire; on indicating motors it is connected to a brush on one end of the shaft. In both cases the opposite end of the field circuit is grounded to the rotor and through a ground brush to the frame. The rotor is carried on precision ball bearings. The field of all motors in any installation are connected in parallel to a single AC power supply. The stators of each pair of Autosyns must be individually connected by three wires.

When a pair of Autosyn motors are connected electrically and the system energized, any movement of the rotor of the transmitting motor is instantly duplicated by a corresponding movement of the rotor of the indicating motor. An indicating mechanism such as a pressure gauge, thermometer or tachometer is mounted as close as possible to the engine. The pointer shaft of the mechanism instead of being attached to a pointer, is attached mechanically to the rotor of the transmitting Autosyn motor, the motor and indicating mechanism being mounted in a common case. An indicating Autosyn motor in a case having standard AN mounting dimensions is installed on the instrument board and its rotor is attached to a pointer which is free to move over a scale. Any motion of the indicating mechanism is translated to the rotor of the transmitting motor and the pointer on the indicating motor moves equally, showing engine pressure or temperature changes.

A variation of the simple Autosyn system described above is the Dual Autosyn indicator. In this type of indicator, two motors are mounted in tandem with the shaft of the rear motor extending through the hollow shaft of the front motor. Each of the indicating motors is connected to a separate transmitting motor. In this way indications for two motors may be shown simultaneously on one dial. The accompanying illustration shows the dual indicator for engine speed of the two right hand engines of a four-engined ship. Such an indicator may also be used for taking readings from both engines of a bi-motor ship, and for indicating the amount of fuel in the two tanks.

A further variation involves the use of tandem multi-scale indicators used in conjunction with a selector switch. This combination makes it possible to read on one dial as many as four different functions such as oil pressure, oil temperature, manifold pressure and fuel pressure for two engines. Accompanying illustrations show a four scale tandem indicator

(Continued on following page)

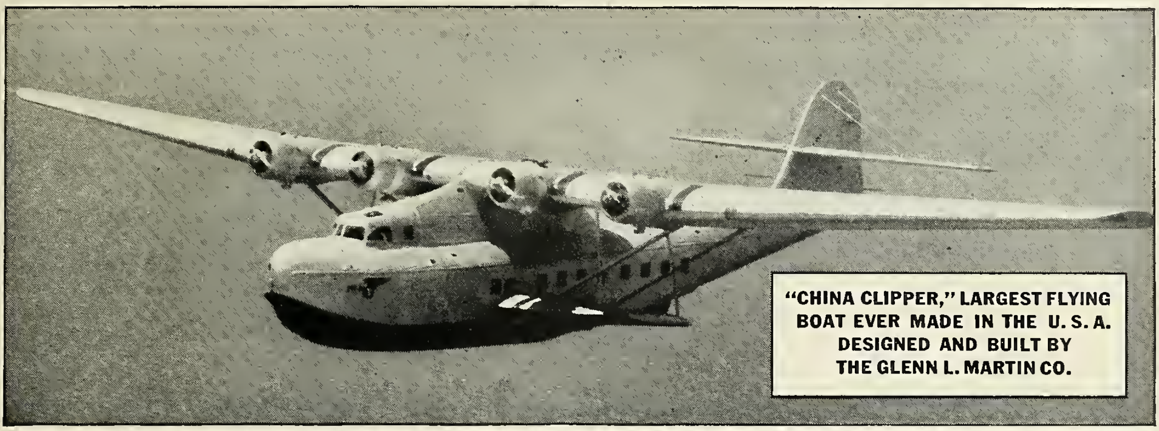
Autosyn position indicator

Dual tachometer indicator

Selector switch

Four scale dual indicator

AGAIN MARTIN CHOOSES GOODRICH FOR PAN AMERICAN *TRANS-PACIFIC* "CLIPPERS"



"CHINA CLIPPER," LARGEST FLYING BOAT EVER MADE IN THE U. S. A. DESIGNED AND BUILT BY THE GLENN L. MARTIN CO.

12 Goodrich "*Safety Products*" Engineered Into New Martin-Built Super Planes For Pan American's Service to the Orient

LINKING America and the Far East by air, the "China Clipper" not only made aviation history but it also marked another triumph of Martin engineering genius when it passed all tests with flying colors. Thousands of miles of test flights proved how completely Martin engineers had built into the "Clipper" all the speed, safety and stamina that Pan American Airways would require from these ships in regular Trans-Pacific service. They could fly 4,000 miles non-stop, thus easily spanning the largest over-ocean stretch. They could carry profitable pay loads as well as passengers. The East and the West would be brought closer by whole days, even weeks, on a new route specially planned and equipped by Pan American Airways.

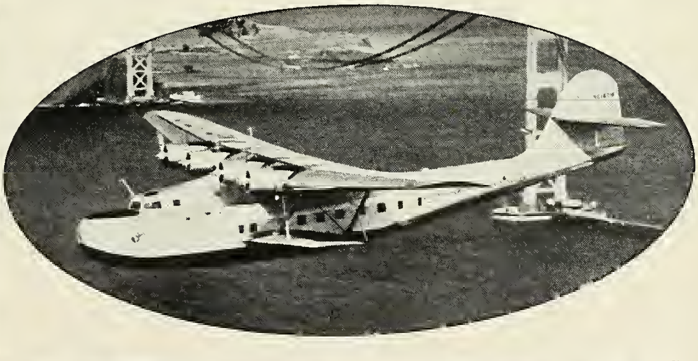
And throughout the construction of the "Clippers," Goodrich Aviation Products again have important jobs. In all, 12 Goodrich Products contribute to the safety and smooth operation of these super ships—products that have been chosen again and again by Martin for their time-tested ability to give long, "trouble-free" service. Another proof that the builder of the famous Goodrich Airplane Silvertown Tire is also the most able builder of the many other rubber products aviation needs today—regardless of whether it's a simple gasket or elaborate De-Icer equipment.

Bring your problem to Goodrich

Don't delay. See your nearest Goodrich dealer now or write to Dept. 610, Aeronautical Division of The B. F. Goodrich Co., Akron, Ohio, for complete information about Goodrich Airplane Silvertowns and the more than 40 other Goodrich Aviation Products.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

- Goodrich Airplane Silvertowns are built on the low pressure principle for greater safety and smoothness on every landing and take-off. The "first choice" of leading pilots, plane makers and air lines clear around the world.

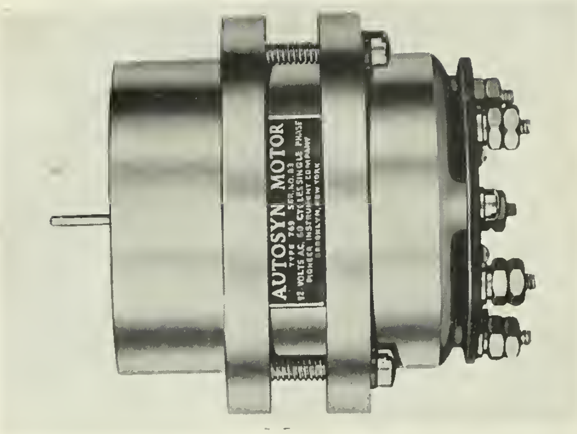


OUTWARD BOUND—A Martin-built "Clipper" passing the Golden Gate on a 2,410 mile "hop" to Hawaii over Pan American Airways' newest air trail. "Clippers" are equipped with Goodrich Rubber Gaskets; Sponge Rubber Strips, Seals, Pads; Sponge Rubber with Fabric Backing; Rubber Cements; Live Rubber Strips; Rubber Bushings; Grommets; Gasoline Hose; Airplane Matting; and Goodrich Tires for Beaching Gear.

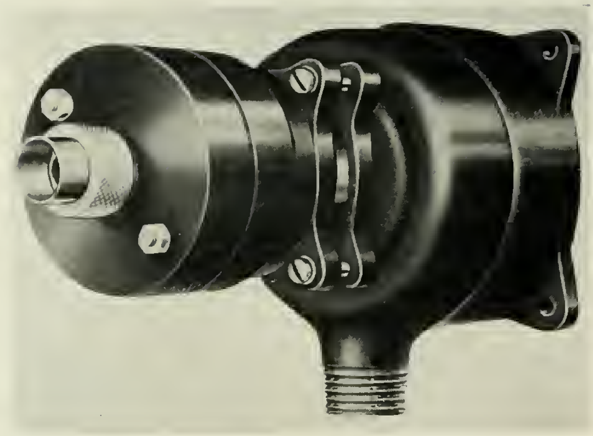
Goodrich *Airplane* Silvertowns

THE SAFEST AIRPLANE TIRE EVER BUILT

Over 40 Rubber Products for Airplanes — including Tires — Tail Wheels — Abrasion Shoes — De-Icers — Matting — Rubber Hose — Grommets — Shock Absorber Cord — A Complete line of Rubber Aeronautical Accessories.


AUTOSYN MOTOR
TYPE 769 SER.NO.83
12 VOLTS AC. 60 CYCLES SINGLE PHASE
PIONEER INSTRUMENT COMPANY
BROOKLYN, NEW YORK

Full size illustration of Autosyn motor



¾ rear view of the Autosyn tachometer transmitter

(Continued from preceding page)

and selector switch. This type of indicator by combining eight instruments in one, affords an appreciable saving in instrument board space. Warning lights may be used in conjunction with the multi-scale indicator to call the pilot's attention to a dangerous condition and the necessity of taking a reading by the proper adjustment of the selector switch. Because of the fact that one Autosyn transmitter will operate two indicators, readings on the multi-scale dials may be reproduced on continuous reading, single scale indicators in the flight engineer's compartment.

The Autosyn combines accuracy and reliability, together with simplicity and ruggedness. It not only eliminates long tubing and drive shafts which are replaced by electric multi-wire conductors, but also errors in oil pressure indication due to oil congealing in the tubes under low temperature conditions, and also eliminates fuel and oil lines from the pilot's compartment, reducing the fire hazard and engine failure possibilities.

It conserves instrument board space on the panel by using dual and multiple scale indication which results in greater ease of reading by the pilot, and reduces service requirements to a minimum due to the simplicity and accessibility to the equipment and the elimination of long tubing.

Sufficient spare conductors can be included in each cable to allow quick substitution of any broken conductor or addition of new instruments. The removal of wings is facilitated by conveniently locating a terminal box or multiple plug near the junction.

The only connection between the transmitters and indicators is the small electrical conduit. Both transmitting and indicating motor elements are nearly identical, the case being the principal difference. Instrument board indicators are fully interchangeable by changing the dial.

Alternating current, which is a required part of the system, can be used for ultra-violet light instrument panel illumination. While the radium paint is sensitive to ultra-violet, the visible "white light" cockpit illumination is kept at a minimum. This results in increased piloting efficiency, and in military aviation operation, adds a special feature of safety.

Autosyn transmission applied to the airplane may be adapted to the remote electrical indications of almost any desired instrument function.

Applications of Transmission

Engine gauges: For engine conditions of pressure and temperature, standard instrument elements such as Bourdon tubes and diaphragms, are mounted as part of the transmitting Autosyns. For multi-motor airplanes, dual indicators in conjunction with selector switches and warning lights, are desirable. These give the pilot the necessary engine information, saving confusion and instrument board space.

Tachometers: a conventional type mechanical tachometer element is connected directly to the transmitting Autosyn. The value of a short flexible cable is apparent in this case.

Fuel flow indicators: the transmitting element, located in the fuel supply line to each engine, operates a quantity per unit time indicator. Autosyn has made possible accurate fuel flow indication.

Fuel quantity indicators: standard fuel level elements of an improved design, principally of the float type, are incorporated with Autosyn transmission.

Position indicators: Autosyn transmission is adaptable to remote indication of position of landing wheels, tail wheel, flaps, control surfaces and doors.

Radio: where radio equipment is installed in the rear of a ship, tuning can be accomplished by electric motor drive controlled from the cockpit. Autosyns can be used to transmit the position of the condenser being tuned. Also, Autosyn can be used to indicate accurately radio loop bearing indications on a dial on the instrument board.

Single phase alternating current is used for supplying the energy to the Autosyn system. While the system can be designed to operate under any condition in a wide range of frequency, the standard is for 32 volts, 60 cycle or 110 volts, 800 cycle. There are several possible sources for this current supply.

With the increased demand for electric current, on large aircraft, to operate various accessories, the demand will soon exceed the current available from storage batteries. It is apparently a logical step therefore that separate power supplies will be installed. Due to its many advantages, it is certain that alternating current will be used to supplement the direct current supply to these functions which can be operated more efficiently by alternating current.

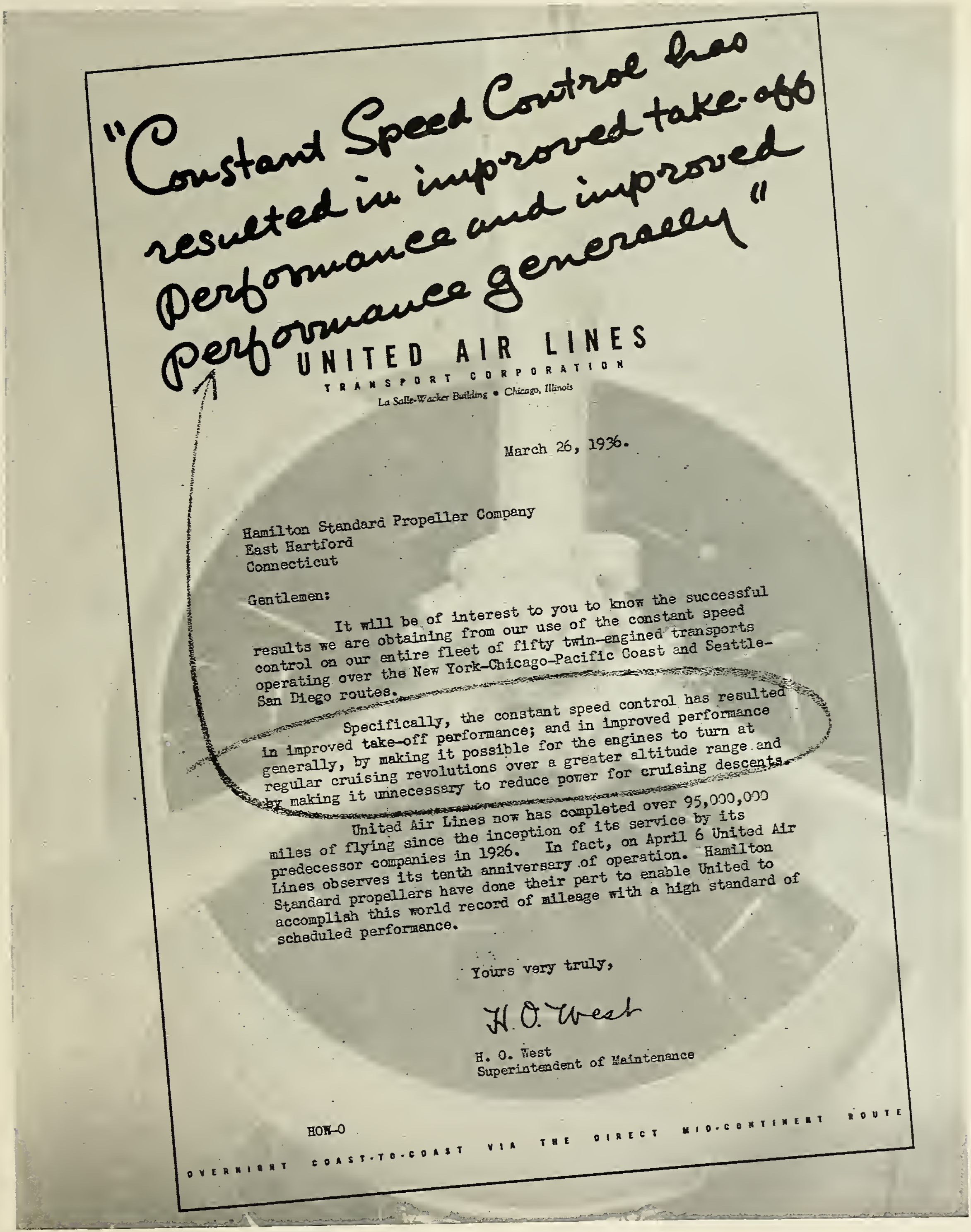
Alternating current supply, especially high frequency will give greater efficiency and less weight for operation of electrically-driven accessories, radio, cabin lighting and Argon panel illumination as well as landing and navigation light. This power supply can also be used to energize the Autosyn system.

In general there are three sources for the alternating current power supply:

1: Engine-driven alternators may be installed and suitably operated. This system is recommended only where a separate power plant is not available. Each alternator may supply power for the Autosyn instrument associated with a particular engine to which they are connected or in the case of a multi-motor ship, a system of two alternators each capable of carrying the full Autosyn load, may be advisable.

2: A dynamotor or converter operated by the direct current supply may be used.

3: An alternating current system installed for operation of radio or any other accessory, may also be used to operate the Autosyn system.



"Constant Speed Control has resulted in improved take-off performance and improved performance generally"

UNITED AIR LINES
TRANSPORT CORPORATION
La Salle-Wacker Building • Chicago, Illinois

March 26, 1936.

Hamilton Standard Propeller Company
East Hartford
Connecticut

Gentlemen:

It will be of interest to you to know the successful results we are obtaining from our use of the constant speed control on our entire fleet of fifty twin-engined transports operating over the New York-Chicago-Pacific Coast and Seattle-San Diego routes.

Specifically, the constant speed control has resulted in improved take-off performance; and in improved performance generally, by making it possible for the engines to turn at regular cruising revolutions over a greater altitude range and by making it unnecessary to reduce power for cruising descents.

United Air Lines now has completed over 95,000,000 miles of flying since the inception of its service by its predecessor companies in 1926. In fact, on April 6 United Air Lines observes its tenth anniversary of operation. Hamilton Standard propellers have done their part to enable United to accomplish this world record of mileage with a high standard of scheduled performance.

Yours very truly,

H. O. West

H. O. West
Superintendent of Maintenance

HOW-O

OVERNIGHT COAST-TO-COAST VIA THE DIRECT MID-CONTINENT ROUTE

HAMILTON STANDARD PROPELLERS

East Hartford, Connecticut

DIVISION OF UNITED AIRCRAFT MANUFACTURING CORPORATION

EQUIPMENT and METHODS

●

Instrument Illuminator

A new *Moon Glow* type aircraft instrument illuminator and map light has been put into production by Fairchild Aerial Camera Corp.

The illuminator measures 3.75" × .875" and has a current consumption of .25 amp. per unit at 12 volts. The metal shell of the device is fitted with a knurled ring at the forward end of which the diaphragm, through which the light is projected, may be adjusted. The light bulb is mounted on a socket which fits into the rear end of the shell.

In the side of the shell is a window fitted with a sliding shutter which may be opened to light the cabin. Between the bulb and the diaphragm is a light-collecting lens; another lens is at the forward end for confining the beam to a definite area. This optical system permits perfect control of the beam shape on the panel. If it is desired to confine the beam to a few instruments or a special group it is merely necessary to insert a correspondingly shaped mask at the focal plane of the projection lens. The most effective location for the device is above the head of the pilot on the center line of the airplane, with the forward end aimed at the instrument panel.

Steam Type Engine Starter

A steam type airplane engine starter is now being tested by W. E. Huffman, of the miscellaneous equipment laboratory at Wright Field, Dayton, Ohio.

The equipment consists of a flash type boiler actuated by a gasoline burner, and a four-cylinder Vee type engine, shown at the lower left of the photograph.

The starter was designed for use in extreme cold weather. The new steam starter is expected to supplant other types for this purpose. According to Wright Field officers it is easy to operate at temperatures where it is almost as difficult to start the gasoline engine of the old type starter as it was to start the airplane engines themselves, and it will also eliminate the problem confronting the user of the all-electric type, whose batteries ran down when constantly used.

The apparatus approximates other types in weight and portability. It operates at 80 lbs. steam pressure, and one is considered sufficient for a squadron.

It is also planned to install coils in each oil tank of the airplanes to be used in cold weather. The procedure then would be to liquefy the oil by steam from the starter boiler, and then to start the engines.

Flexible Shaft Grinder

A flexible shaft, portable grinder that develops ⅜ hp. and a speed of 18,000 r.p.m. is now manufactured by The Stanley Electric Tool Division, New Britain, Conn.

This grinder can be used for external and internal grinding operations on tools, dies, castings, etc. The universal motor provides ample power to drive a 1½" × ½" emery wheel and maintain a high grinding speed on the toughest work.

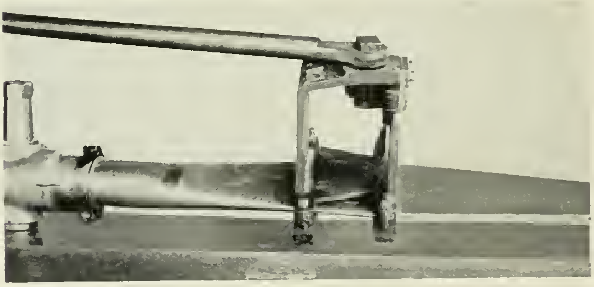
The flexible shaft, 42" long, has a rubber reinforced casing with protection springs on each end.

Service Finish For Hangar Floors

Concrete has been found ideally suited for floors of hangar and airport buildings where a non-slippery and long-wearing surface is a prime requisite. However, concrete is cold and lifeless and many attempts have been made to improve its appearance and to protect it from the severe usage to which it is too often subjected.

Aeronautical Industries Research, Dubuque, Ia., has developed *Hangairlite,* a service finish that will not peel or chip, and is easy to maintain and clean. Essentially a copal gum product, *Hangairlite* has penetrating qualities which cause it to become an integral part of the floors or walls to which it is applied. It seals the pores of the concrete, preventing absorption of anything dropped on the floor, and keeps grease and grit from being ground into the pores.

Treating floors for an application of *Hangairlite* requires the use of *Hangairsolv,* a grease and oil solvent, and *Hangairclean,* a cleansing agent that prepares the floor for the final coating as well as being used to keep it attractive once the floor is processed.



Propeller Servicing Equipment

Northwest Air Service has developed a device for straightening and pitching metal propellers.

The unit is simple to operate, is not bulky and can be handled by one man. In operation, it is clamped on the blade, which in turn is mounted on the pitch table. Thus, the pitching and straightening work can be done without removing the propeller from the stand, and without removing the protractor. The combination of these features decreases the time consumed in straightening and pitching the blades, and also tends for more accurate work.

The fact that the gear ratio is 6:1, and also that there is great leverage at the end of the bar, allows for ease of operation. The operation begins nearest the hub at the point where the blade is bent and proceeds toward the tip as each station is brought up to alignment. Since there is 6 inches between the racks, work is done in 6-inch stations.

Combination Watch

The Pierce-Chronograph is a combination wrist-watch, stop-watch, telemeter and tachometer combined in one compact unit.

As a stop-watch, the instrument will time in seconds and fifth of seconds; as a telemeter, it will indicate the distance away from the observer of light or sound; and as a tachometer, it will indicate the number of miles per hour an object is moving.

The watch will be ready for general sale about the first of this month.

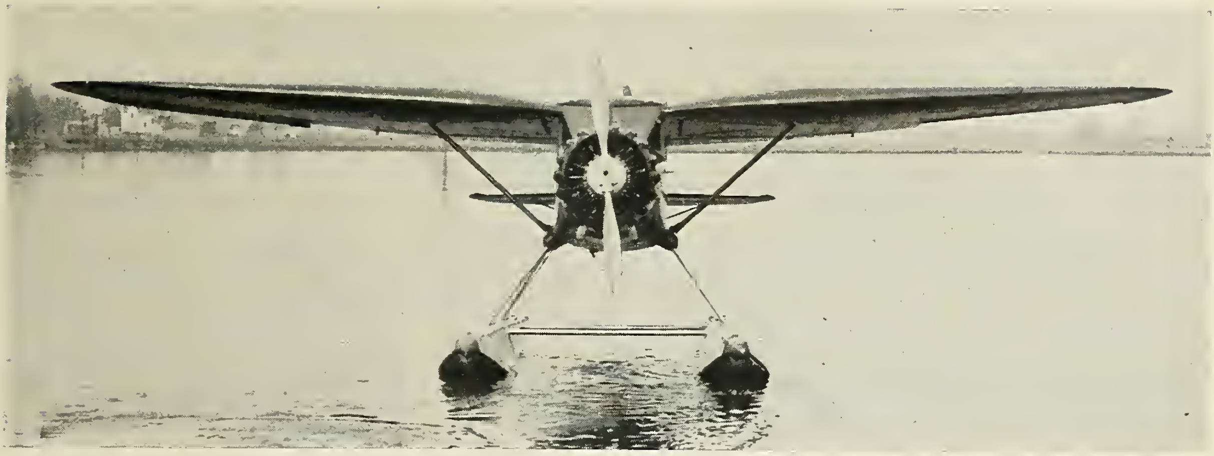
Synchronizing Engines

Synchronization of engines of multi-engined aircraft to a fraction of 1 r.p.m. slower or faster with resultant minimization of vibration and cabin noises, is accomplished through the use of an engine synchronizer developed by Luther Harris, superintendent of maintenance for Central Airlines.

This instrument is of standard aircraft size and is located on the instrument panel of the plane, in this case tri-motored Stinson Model A Airliners. The unit consists of a rotating white disc with nine black spots equally spaced on the face. This disc is driven with a small tachometer shaft or an electric motor, depending on whether it is desirable to synchronize engines at all speeds. In the tri-motored installation, the disc is driven by the center engine, and the outboard engines are synchronized to it by neon tubes placed inside the instrument.

The instrument is partitioned from the disc to the cover to prevent light from one neon tube interfering with the light from the other tube. The principle of the stroboscope is utilized and when the spots appear to stand still, all engines are in absolute unison. After engines are synchronized the instrument will indicate to 1/100 r.p.m., gain or loss, of one propeller over another.

The neon tubes are actuated from the ignition system of the engine to which it is connected.



Stinson Reliant (Model 1936 SR7-B) On Pontoons

"GETS OFF LIKE A SCARED TEAL"

The 1936 Stinson 'Reliant' Model SR7-B takes on the characteristics of a water bird when equipped with Pontoons.

A noted Authority states—"That plane acts more like a land plane than any pontoon job I ever tested. The way it FLYS OFF glassy water with 5% overload is extraordinary".

For the Sportsman or Commercial Operator this Stinson is truly the "Float Job" of the year with its wings HIGH out of the spray and its structure built to "take it" under conditions where less capable craft are in the Hangar.

If you contemplate the purchase of an airplane equipped with Pontoons, investigate this 1936 Stinson Reliant before you buy— its superiority is outstanding.

SEND FOR MAY ISSUE
STINSON PLANE NEWS

Stinson Aircraft Corporation

Division of Aviation Manufacturing Corp.

WAYNE MICHIGAN U. S. A.

☆

SPEED

Cruises Over 120 MPH

☆

TAKE OFF

Under 30 Seconds with full load on 'glassy' water.

☆

CLIMB

Initial Climb More Than 650 FPM.

☆

LANDING

Lands short after steep glide over obstructions by using Slotted Vacuum Flaps.

☆

USEFUL LOAD

1200 Pounds

☆

Personairlities

By Caldwell

● Mal B. Freeburg writes me—"Am undoubtedly the laziest man in the world and my pet hobby is loafing, which I do more proficiently than any other man I have met. If not too much effort is involved, I also like to hunt and fish. My laziness undoubtedly accounts for the fact that I have made the fastest flying time between Minneapolis and Chicago, one hour and 35 minutes, as I work on the theory that the sooner I get there the sooner I can start loafing."

He was loafing along with a load of mail from the Twin Cities bound for Chicago one night in July, 1930, when he noticed an unusual glow beneath him. He was near Trevino, Wis., at the time; and around Trevino, if I recall that burg correctly, more than one 25-watt light would be an unusual glow. So Freeburg naturally dropped down to look it over and discovered that the Chicago, Burlington & Quincy Railroad bridge over the Chippewa River was on fire—it was discovered later that a passenger on the train ahead had carelessly dropped a copy of "Lady Chatterley's Lover" out the window.

Farther back, Freeburg had passed over a train, the crack *Empire Builder,* that was speeding along through the night toward the burning bridge. Freeburg turned back on his course until he met the train; by that time it had passed the last open telegraph station, which cut off any opportunity of the railroad people being able to warn the engineer of the danger. The air-mail pilot circled the train, flying low, flashing his landing lights and dropping a flare. The engineer brought his train to a stop a quarter of a mile from the burning bridge, in real Al Woods melodrama style. There was a beautiful girl on that train. Realizing that a handsome air-mail pilot had saved her life, she cried, "That is the man I am going to marry!" But as it turned out, he was already married. So she married a drummer from Milwaukee and hasn't been heard of since. Mal Freeburg, incidentally—though this is hardly an incident to him, but an event—has been married for ten years and has two children, Jimmy, 6, and Patsy, 2.

Of course, trains have been stopped before by air-mail pilots, but Mal Freeburg made national news with that short-stop because Bobby Jones the golfer was on the train. If Mae West had been aboard it would have made the front page in Moscow and Shanghai. The railroad gave the pilot a gold watch and the Chicago Daily News gave him $100. The Burlington mentioned that the automatic block signals would have saved the train anyhow, but nobody listened.

Mal B. Freeburg

Mal was born March 6, 1906, in Blackduck, Minnesota, where the temperature hit 50° below zero every winter for the 13 years that he went to school there. His father was a dentist and finally got discouraged with practice in Blackduck, as he had to thaw out the yokels' teeth with an acetylene torch before he could begin drilling or blasting operations. So he moved to Minneapolis where Mal graduated from West High, went to the University of Minnesota, and then sunk into aviation. He learned to fly under Verne Roberts, the old maestro of the Monocoupe, at the old Speedway Field in Minneapolis early in the spring of 1926. He immediately became a minor hazard to the public by starting out on a barnstorming tour; he covered towns that had been lost sight of since the last covered wagon stopped at them with the last settler. Then he settled down at Shenandoah, Iowa, the biggest little town in the U. S., where he owned and operated the Kiwanis Airport and to keep life from being monotonous made side trips with C. A. Blackstone, who rejoiced in the name of Dare Devil and lived up to it by hanging from airplanes by his toes, a position in which I would be very happy to see Jobmaster Jim Farley and Senator Black, Chief Inquisitor of the Senate.

In the fall of 1928, Freeburg sold his Shenandoah interests to the Lincoln School of Aviation and went to work for Northwest Airlines, Dec. 12. Opening the Green Bay run Dec. 15, 1928, he shuttled back and forth between Milwaukee and Green Bay for 7 months, then opened the night mail run from Minneapolis to Chicago, July, 1929. He has been at it ever since, has 7,400 hours, over 5,000 of them at night. He made the first landing with high-speed equipment with wheels up at the St. Paul Airport amid the groans of the officials and the cheers of the spectators. No damage resulted. His specialty, however, is losing engines with great nonchalance and without inconvenience to his passengers.

On the afternoon of April 12, 1932, Freeburg was flying the line between Twin Cities and Chicago with co-pilot Joe Kimm and a load of 8 passengers in a tri-motored Ford—— Of course you've heard about this incident, but I'll tell it again. They were flying at an altitude of 2,000 feet, the weather was ideal, the engines were humming smoothly, and all was peace. Then there was a sudden and terrific jolt. A glance showed Freeburg that the left outboard engine was vibrating terribly. He immediately cut the switch and radioed his operations office, "Freeburg speaking. Propeller on left outboard motor just let go." As he was speaking, and with his hand still on the switch, the engine also let go; then he cut the other two and said calmly into his microphone, "Loose motor has lodged in the left landing gear struts." He then switched on the two engines and still had about 1,800 feet of altitude, with the plane operating fairly well considering the additional resistance caused by the engine shell still being with the plane, and the large opening due to the loss of the engine from its nacelle. His next thought was to get rid of that engine in order to make a reasonably safe landing.

He was flying over a farming district which was full of farmers harassing Hoover and waiting for Roosevelt and Relief. Freeburg didn't want to drop that engine on one of them and thus knock out a Democratic vote, so he changed his course and started for the Mississippi River, advising his operations office in St. Paul, which by this time was completely packed with officials and others, all developing varying degrees of the jitters. Upon approaching a fair-sized uninhabited island in the river he maneuvered the plane so that the engine was dislodged from the struts and fell off; but as this was Freeburg's first attempt at bomb-dropping he missed the target, and the engine missed the island and landed on a farm, which it failed to damage, as the farm was completely covered by a mortgage.

Now all that Mr. Freeburg had to worry about was the fact that he was 25 miles away from the emergency field at Wabasha, that the damage to the wheel was such that it couldn't revolve, that the tire was cut open, and that the ship might possibly have been weakened so that it would fall apart. Outside of that he had nothing to worry about except to keep the officials advised of his progress. He had sent Joe Kimm back soon after the accident to reassure the passengers, and they were bearing up well though wondering idly if, after all, it might not have been better to take the train. The officials mean-

(*Continued on page 68*)

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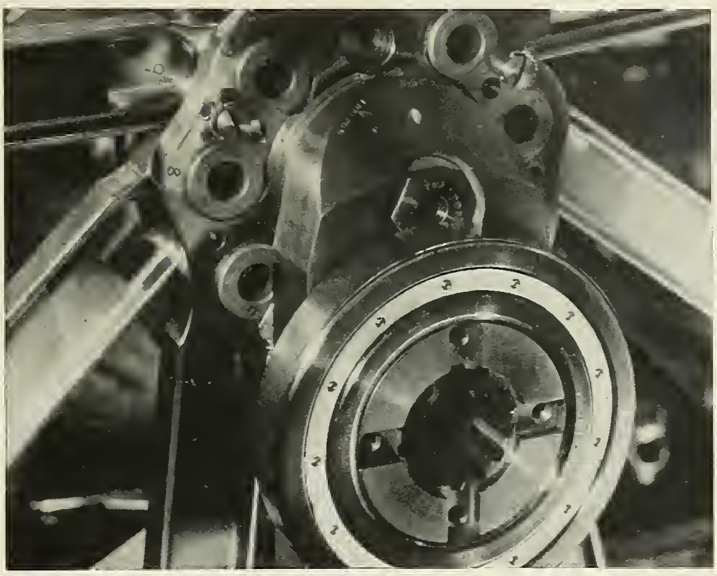

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ACTIVITIES AT THE SCHOOLS

Boeing Awards

Jack A. Gibbs of Oregon State College won the first award in the Seventh Annual W. E. Boeing Scholarships and will receive a complete airline pilot and operations course at the Boeing School of Aeronautics. The second award went to E. Brewster Buxton of the University of Wisconsin; third place to John E. Lindberg, Jr., University of California; and fourth to H. B. Owsley, University of Michigan. Total value of the scholarships is $9600.

Towing Basin

A towing basin for the testing of flying boats, seaplane floats and allied subjects was opened at New York University, it was announced by Dr. Alexander Klemin, director of the Guggenheim School of Aeronautics of the University's College of Engineering.

The basin is 150 ft. long, 8 ft. wide and 4 ft. deep, with a total capacity of 36,000 gal. of water. The design of the basin and its operating and recording apparatus was carried out under the supervision of Dr. Klemin and Assistant Professor Frederick K. Teichmann with the assistance of John Becker and Vincent Condello, graduate students.

Personnel Notes

Wilbur Wood, design engineer for the Douglas Aircraft Co., has been added to the staff of instructors at the Curtiss-Wright Technical Institute of Aeronautics. Wood is conducting a class in blue print readings.

* * *

T. Claude Ryan announced that Millard Boyd, chief engineer for the Ryan Aeronautical Co., will also assume charge of airplane drafting and blueprint reading classes at the Ryan School of Aeronautics.

* * *

Jerome Lederer, chief engineer, Aero Insurance Underwriters, has been appointed lecturer on Air Transportation at the Daniel Guggenheim School of Aeronautics, New York University. Topics included in the course include Accident Analysis, Operation and Maintenance Procedure and Forms, Operation of the Federal Airways System, Preparation of Manuals, Physical Analysis of Routes, Insurance Analysis of Airline Operations, Accident and Fire Prevention and Governmental Regulations.

Roosevelt Moves

Roosevelt Aviation School for many years located on Unit 1, Roosevelt Field, Garden City, has moved into enlarged quarters on Unit 2. Three buildings have been remodeled to receive both the flying and the mechanic divisions of the school.

With additional equipment and greater facilities, the school is expected to expand in both its flight and ground school activities.

New Courses

One of the new courses at Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, includes instruction in aeronautical drafting. Although the contents of the new course have been given in the past in another course at the Institute, this is the first time that this department of work has been made available in a separate course. The course covers thirteen weeks.

* * *

Elementary and special advanced problems pertaining to stratosphere flying use and construction of equipment are being covered in lecture, laboratory, and seminar courses at the University of Minnesota, Minneapolis, with Prof. Jean Piccard in charge. The course began March 28 and ends June 12.

During this quarter, senior and graduate courses in Aeronautical Engineering are also available and include Aircraft Radio, Engine Testing, Airplane Design, Airships, Problems Pertaining to Stratosphere, Advanced Aero. Lab., Air Transport, Advanced Airplane Design, Propeller Design and other courses.

Enrollments

Reports from the Warren School of Aeronautics, Los Angeles, are to the effect that attendance is now at its peak, more than 50 new students having enrolled within the past three months. The school specializes in the training of airplane mechanics for factory construction work.

* * *

Spring classes at the Casey Jones School of Aeronautics started March with an enrollment of forty new aeronautical engineering and master mechanic students, again bringing the school up to capacity and necessitating another waiting list for future classes.

PRIVATE FLYING AND CLUB NEWS

Elections

Moss Patterson has been elected president of the Aviation Club of Oklahoma City to succeed Orval Mosier, city manager. Other officers chosen were: Jimmy Sass, first vice-president; Herbert Howell, second vice-president; Mrs. Wilma McManus, secretary and Clyde Nichols, treasurer.

* * *

Officers of the Indiana Aircraft Trades Association re-elected at the annual meeting were Frank E. Ball, president; Walker W. Winslow, vice-president; Herbert O. Fisher, secretary; Mike Murphy, treasurer.

* * *

Robert B. Hall has been elected president, for the eighth successive year, of the Chesapeake Flying Club. Other officers chosen for the coming year are: William J. Wells, vice-president; Clarence Fisher, secretary-treasurer; Gail King, flight manager and Paul Pfeiffer, membership committee.

Tours

Daily and all-tour prize awards will be a feature of the 1936 Missouri state air tour which will start June 12 at St. Louis, and disband June 14 at Columbia.

From the take-off point, the tourists will land at Hannibal for lunch, and make a night stop at Kansas City for a formal banquet. Reaching Springfield early in the afternoon of the second day of flight, the pilots will go by bus to Rockaway Beach, Lake Taneycomo, where golfing, tennis, swimming and dancing facilities are available, to spend the afternoon and night. The tour will break up at Columbia at noon on the third day. The Lambert-St. Louis Airport Association is sponsoring the tour.

* * *

Planes in the Eighth Annual Indiana Air Tour will take off from Indianapolis, June 22, and will return to the Municipal Airport there, June 28, after visiting approximately a score of cities, it was decided at the annual meeting of the Indiana Aircraft Trades Association, sponsors of the event. This tour is operated on a non-commercial basis and is promoted each year in an effort to stimulate public interest in Indiana and to promote a more intelligent support of aeronautics as a means of transportation, and to cooperate with civic organizations of each city visited in order to create more interest and development in their airports and their facilities. While the tour last year had 57 official entries, this year it will be limited to 60.

Aerial Survey

A regular Saturday schedule of air cruises over metropolitan Chicago was started last month by the Northern Illinois Chapter of the Society of Residential Appraisers to study land perspectives. Roger P. Minwegen is chairman of the chapter's research committee. The recent revival of interest in subdivisions and other property developments has called for methods more conducive to obtaining a definite perspective of the relative positions of land location and values as contrasted with surroundings.

New Organizations

A group of Los Angeles pilots have formed Sport Wings in an endeavor to promote sport and social activities in local aviation circles. The club expects to concentrate its initial efforts toward air tours and expects to stage aerial treasure hunts and other aerial activities. Twenty-five pilots attended the organization meeting held at the Grand Central Air Terminal and appointed a committee to complete the details of organizing the group. This committee included Wallace Timm, chairman, L. Therkelson, N. Larson, B. Rhine, Dr. Ward Williams, Al Essig, Warren Carey, Ben McGlashan and Ted McClellan.

Intercollegiate Meet

More than 100 delegates from thirty colleges and universities attended the recent second National Intercollegiate Flying conference in Washington. During the meeting it was decided to hold the second National meet on June 19 and 20 at Detroit at the Wayne County Airport, where gliding and flying events will be contested. The conference also adopted four standard events for all intercollegiate competition.

The Loening Trophy was awarded to the University of Minnesota for the second successive year, and honorable mention was given to Amherst, Harvard, Purdue, and Michigan. William D. Strohmeier, last year's president, was succeeded by Joseph B. Hartranft, Jr.

Front Page NEWS!

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AIRLINES AND AIR TRAVEL

41,330 Passengers

Passenger traffic in February, 1936 exceeded that for the same month in 1935 when 41,330 passengers flew with the 21 companies operating during that period. In February 1935, there were 34,998 persons who flew on domestic airlines.

Compared to January, 1936, February figures were lower, 44,061 passengers being carried in the first month of the year. It is pointed out, however, that 23 lines operated during that period.

Miles flown in February were 3,957,795 and passenger miles amounted to 18,121,502. Twenty of the companies carried 353,194 lbs. of express and flew 196,969,622 express pound miles.

The report, issued by the Bureau of Air Commerce, also reveals the fact that 44.33% of the seating capacity was utilized in February as against 43.92% in January, 1936.

* * *

Central Airlines reports a 212% passenger traffic increase during March, 1936 over the preceding month on the Washington, Pittsburgh, Akron, Cleveland, Detroit airway. 110,432 miles were scheduled for March, and 100,039 miles flown. Air mail carried increased 29% from 31,641 pounds, in February to 40,911 pounds in March, and a 142% increase in air express was shown.

* * *

Passengers and express transported by Pennsylvania Airlines on the Washington-Detroit-Milwaukee division of the line during March exceeded February business by substantial percentages, according to W. J. Austin, vice-president.

The most outstanding rise was recorded by air express which showed an increase of 581% over February; passenger business increased 488% on the Detroit-Milwaukee division of the line and 80% on the entire system. Air mail was 120% ahead of the previous month and 183% ahead of March last year.

* * *

Northwest Airlines, Inc., carried 25,123 passengers in 1935, more than double the 12,097 carried in 1934, according to K. R. Ferguson, general traffic manager. Mileage flown by the company's fleet of Electras in 1934 was 2,841,198, compared with 1,543,127 miles flown in 1934. Air mail poundage jumped from 91,113 in 1934 to 648,492 in 1935, while air express poundage more than quadrupled.

New Equipment

Chicago and Southern Air Lines will put four new Wright Whirlwind-powered Lockheed Electras in service between Chicago and New Orleans on or about May 1.

The elapsed schedule, Chicago to New Orleans, will be 6 hours 55 minutes, as compared to the present time of 10 hours 40 minutes. All of the present stops will be made in the new service. Co-pilots will be employed on all flights and lunches will be served. The planes now in service will be retired.

* * *

National Park Airways will spend about $100,000 to purchase new equipment and modernize that which is now in use on its Salt Lake-Great Falls, Montana route. Contemplated improvements include the installation of new engines, three-bladed propellers and automatic carburetors. The line also expects to purchase another Boeing 247 transport.

Safety In The Air

Scheduled airlines of the United States flew 1,054,882 miles per accident and 17,973,698 passenger miles per passenger fatality during the last half of 1935, according to the Bureau of Air Commerce.

Miles flown per accident exceeded those for any previous six months period shown in Bureau accident reports on airline operations, but the passenger miles flown per passenger fatality have been higher in several previous half years. There were 3 fatal accidents in which 11 passengers, 3 pilots, 3 co-pilots and 2 crew members lost their lives.

Statistics provided cover operations of all airlines operated by companies in the United States, including domestic lines and foreign extensions. Domestic airlines, in this period, had 30 accidents, flying 1,024,607 miles per accident; foreign lines had 3 accidents (none fatal) and flew 1,357,628 miles per accident.

Causes of accidents were as follows: Personnel errors, 18.18%; power plant failures, 33.33%; airplane failures, 21.21%; weather 15.15%; airport and terrain, 3.03%; other causes, 6.06%; undetermined and doubtful, 3.04%.

Accidents classified by nature showed that the 33 accidents included: collisions in full flight with objects other than aircraft, 2; spins or stalls (engine failure), 1; spins or stalls (not engine failure), 1; forced landings, 7; landing accidents, 13; take-off accidents, 5; taxiing accidents, 3; miscellaneous, 1.

Ticket Offices

In anticipation of a continuous increase in passenger traffic, Delta Air Lines and Braniff Airways have opened a joint ticket office in the lobby of the Baker Hotel in Dallas. L. W. White, city traffic manager of Braniff, and W. R. Beattie, city traffic manager of Delta, are companies' representatives in the office, and R. D. Garnett is in charge.

* * *

A new district office of United Air Lines was opened in Boston at 18 Providence Street. E. J. Whitcomb, who is in charge, has been appointed district traffic manager.

* * *

Chicago and Southern Air Lines moved their Bankers Building ticket office to a more centralized location at No. 33, lobby floor, the Palmer House, Chicago. This move is the first step in several modernizing steps to be taken by F. F. Vennegut, local district traffic manager.

Braniff Lines

Officers of Braniff Airways, Inc., are discussing plans for a day passenger service between Dallas and Chicago via Kansas City and Tulsa. The company suspended its Kansas City, Tulsa and Dallas day service in February under orders from the Post Office Department after American Airlines had alleged its service through Tulsa was being duplicated.

Air Mail

Volume of air mail carried in January totalled 1,177,753 pounds, an all-time record for this month, exceeding by 357,467 pounds the volume for the same month last year, the previous record January. New air mail poundage marks were established during every month of 1935, the total volume for the year being 13,276,023 pounds. This is approximately twice the poundage carried during each of the two previous years. Air mail postage revenues for the last fiscal year amounted to $6,589,534.

Based on an increase in air mail poundage for the present year in ratio with the monthly increases registered throughout 1935, it is anticipated that air mail postage revenues for the present fiscal year will be between seven and eight million dollars.

Schedule Changes

An additional non-stop flight was established April 1 between St. Louis and Chicago by American Airlines, Inc., making five daily round trips between these cities. Other changes in schedules on the line through Tulsa, Okla., also went into effect on that day. The afternoon ship for Chicago now takes off at 2:49 p. m. instead of 1:39, arriving in St. Louis at 4:48 and in Chicago at 6:29 p. m.

The southbound plane in the afternoon leaves Tulsa at 5:15 p. m. to arrive in Fort Worth at 7:08 and in Dallas at 7:30 p. m. There is no change in morning schedules.

* * *

Northwest Airlines is now operating four round trips daily between Chicago and Minneapolis-St. Paul instead of two. In making the announcement, company officials felt that increased traffic demanded the addition of the trips to the schedules. The new trips will give added convenience to those going to the Twin Cities.

* * *

An increase of 8,200 miles per day of scheduled flying on its coast-to-coast and border-to-border airways is to be made by United Air Lines May 1 to bring its monthly total scheduled miles to be flown to 1,561,890.

Among the new schedules added May 1 were a sixth daily trip between New York, Chicago and the west; a third daily trip between Seattle, San Francisco, Los Angeles and San Diego; an additional shuttle between Los Angeles and San Francisco, and additional service between San Francisco and Reno. An additional shuttle plane was likewise added between Chicago and Cleveland, connecting at Cleveland with planes to Pittsburgh and Washington due to heavy gains in travel between Pacific Coast points, Chicago and the nation's capital.

Dirigible Connection

American Airlines, Inc., and the operators of the new Zeppelin *Hindenburg* will cooperate in the handling of dirigible passengers between New York City and Lakehurst, N. J., during the transatlantic service by the dirigible this summer.

This announcement, subject to the approval of the U. S. Government departments concerned, was made by F. W. von Meister, special United States representative of Deutsche Zeppelin Reederei-Luftschiffbau Zeppelin Corp.

Mr. Von Meister said the cooperative arrangement would begin with the arrival of the *Hindenburg* on its maiden voyage to the United States on May 8 and would continue for the nine subsequent round trips by the airship.

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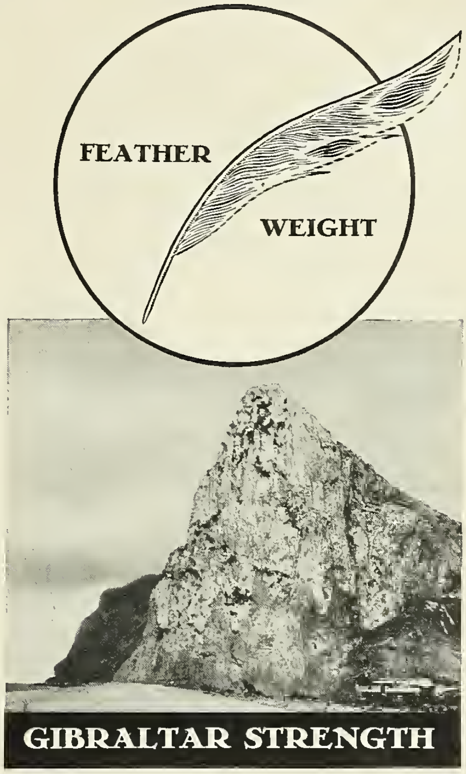

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THE AIR SERVICES

Awards

Capts. Albert W. Stevens and Orvil A. Anderson, officers stationed at Wright Field, Dayton, Ohio, have been awarded oak leaf clusters from the U. S. Army for their record-breaking stratosphere balloon ascension last November. They were awarded the clusters in lieu of a second Distinguished Flying Cross, which they received for their first stratosphere venture in July, 1934.

* * *

On April 13 the Acting Secretary of the Navy presented for the President at the Navy Department, the Distinguished Flying Cross to Lieut. Comdr. Knefler McGinnis, in connection with the flight of the P & W powered Consolidated XP3Y-1 from Norfolk to San Francisco via the Fleet Air Base, Coco Solo, C. Z., in October, 1935.

This flight established a new international airline distance record for seaplanes (of 3,281.402 statute miles) and a broken line distance record (3,443.255 statute miles).

Lighting Equipment

A total of 42 boundary, 5 obstacle lights and 12 floodlights were installed at Scott Field, Belleville, Ill., during the past year to supplement the night lighting equipment already in use. The cost of the new equipment was $18,155.

More than four miles of cable were used in connecting the boundary lights which are set in concrete foundations in the ground and covered with an iron grill.

The new floodlights are 24" in diameter and use 3,000 watt tubular lamps. These are arranged in three series of four floodlights each. Four floodlights are mounted on a bridge assembly, and are adjusted so that their combined light covers a large area of ground.

Photographic School

The first class taking the course in construction and maintenance of aerial photographic equipment, organized by the Fairchild Aerial Camera Corp. for personnel of Army and Navy photographic units, was recently graduated according to Frederick W. Lutz, vice-president and general manager of the camera corporation.

The course included 160 hours of practical and theoretical work in the construction, maintenance, repair and overhaul of aerial photographic equipment manufactured by the camera corporation. It was arranged with the cooperation of Colonel F. L. Martin, Air Corps, Executive of the Materiel Division, Wright Field; Major H. W. Flickinger, Air Corps, Patterson Field; Lieut. Col. Frank D. Lackland, Air Corps, Chief, Field Service Section; Rear Admiral Adolphus Andrews, Chief of Bureau of Navigation; Captain F. R. McCrary, U. S. Navy, Ass't. Chief of Bureau of Navigation; Lieut. T. T. Tucker, U. S. N., Photographic Section.

The class was under the supervision of Joseph Picarelli, Fairchild production foreman.

Radio Equipment

Reports from the U. S. Signal Corps reveal the fact that all of the 1150 combat planes in the Army Air Corps are now fully equipped with radio communication units.

Equipment of the Army's planes meets one of the chief criticisms of the Baker Board following investigation of mail carrying by the Army two years ago when the Post Office Department cancelled the air mail contracts of the private carriers.

No other nation now surpasses this country in radio equipment on planes and in experimental work designed to keep pace with all developments and utilization of radio facilities in warfare.

Aviation Medicine

At a meeting of the U. S. Naval Reserve Medical and Dental Officers' Association in New York, recently, the following medical reserve officers were awarded certificates for having successfully completed the course in aviation medicine in which they were enrolled: Lieut. Comdrs. William J. Fordrung, Manfred J. Gerstley, Max Gratz, Abraham Jablons, Walter R. Loewe and Oscar Wald and Lieut. Lawrence A. Gerlach. The course was conducted by the medical office of the headquarters commandant, third naval district, Navy Department, and was the first of its kind to be held in the United States for naval reserve officers.

Engine Contract

The Secretary of War recently announced the placing of an order with Pratt and Whitney Aircraft Division of the United Aircraft Manufacturing Corp., for 200 new aircraft engines. The total contract amounted to $1,877,030.

These engines, known as the R-1535-13, are the 14-cylinder air-cooled two-row radial type. They will be used for installation in and spares for 100 new all-metal single-engine attack airplanes now being constructed by the Northrop Corp.

Carrier Launched

Aircraft Carrier No. 5 christened U. S. S. *Yorktown* has been launched at the plant of the Newport News Shipbuilding and Drydock Co.

The *Yorktown* and her sister ship, the *Enterprise*, also building at Newport News Shipbuilding, were included in the program of thirty-two naval vessels recently authorized.

Contracts for the construction of these two aircraft carriers were awarded in 1933. On March 1, the *Yorktown* was reported as being 69.4% complete and date of completion as reported by the shipbuilding company will be March 15, 1937. The *Enterprise* was 64.2% complete on March 1, 1936, and is due for completion on July 1, 1937.

The *Yorktown*, is larger than the *Ranger*, having a displacement of 19,900 tons, a length of 761 ft., an extreme beam of 83 ft. 2 in., and a mean draft of 21 ft. 8 in.

Another aircraft carrier, the *Wasp*, designed standard displacement 14,200 tons, is under construction by the Bethlehem Shipbuilding Corp., Quincy, Mass. Her keel was laid on April 1, 1936.

Jack Canary Photo

New Boeing XP-29 Pursuit plane, powered by a 550 h.p. Pratt & Whitney Wasp engine and provided with a retractable landing gear

4000 Planes

The House of Representatives unanimously approved the bill providing for 4000 planes and a reserve personnel of 1350 pilots on active duty, also approved the plan to create an Air Reserve Training Corps and passed another measure to change the promotion system now in effect in the Army Air Corps.

The 4000-plane program was not an appropriation, but an authorization for the procurement of that number of planes at any time during the next five years. The 1350 pilots would be taken from the most capable men now on the reserve lists, although not all that number will be chosen at once, but would be staggered over a period of years in order to obtain the most strength. At the end of five years' service, each officer would receive $500 as a cash bonus.

Change in the promotion system, intended to improve morale, calls for selection of the officer in grade at the top of the promotion list and once elevated he would retain the temporary grade until time for regular promotion or as long as the need existed for one of his grade in the Air Corps. In this manner, temporary promotions will be made in the same manner as normal promotions.

The bills were sent to the Senate where similar favorable action is expected to be taken.

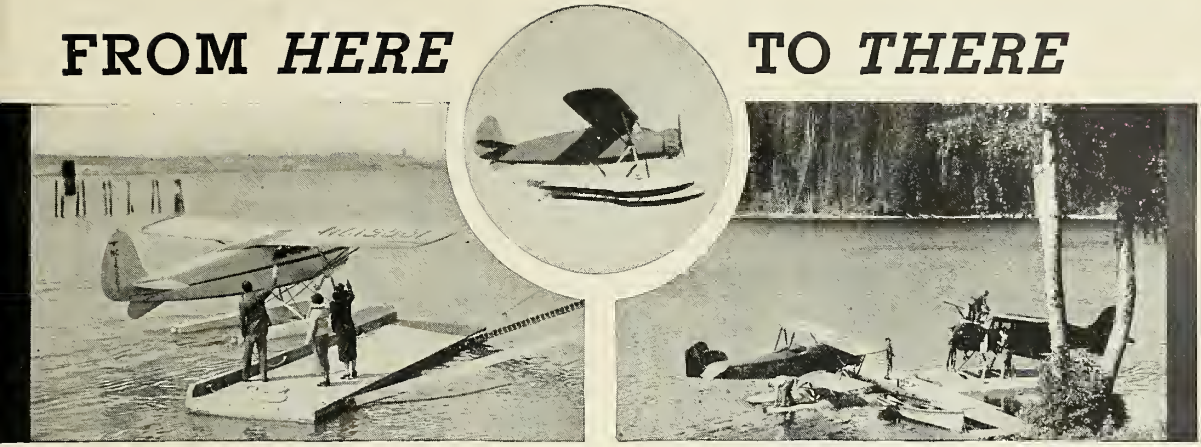
New Scout-Bomber

Differing in appearance from the conventional Vought *Corsair* now used by the U. S. Navy, an experimental two-place airplane built by Chance Vought Aircraft of East Hartford has been delivered to the U. S. Navy for competitive tests on scout-bombers for carrier use.

The new airplane known as the XSB2U-1, is a low-wing monoplane provided with a retractable landing gear, the wheels of which fold into wing recesses. A streamlined transparent cabin encloses the two cockpits, and wings and tail surfaces are faired into the fuselage contour. Structure is of metal, with fabric covering used on the after portions of the wings and fuselage, and on the movable tail surfaces. Power is supplied by a P & W Twin Wasp, Jr., driving a Hamilton Standard controllable-pitch propeller.

National Guard Unit

A branch of the Mississippi National Guard air unit may be established at Meridian, Miss., according to reports. In the event the branch is established at this point, it would concentrate about 30 officers, 60 cadets, several planes, and would be a part of the Jackson squad.



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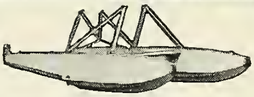

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AT THE AIRPORTS

Seaplane Bases

Housatonic Air Service began operations April 15 at a private seaplane ramp on the property formerly owned by the Huntington Aircraft Corp. in Stratford, Conn. The new company is headed by James A. Wales, Jr., and Charles G. Miller, Jr. Richard B. Wales is secretary and treasurer and Charles R. Tennstedt is chief pilot.

Equipment consists of a 30-ft. wide wooden ramp, a shop, fuel tank and pump, and landing floats. An Aeronca will be used for student instruction and a Robin for taxi and charter work. There will be facilities to store as well as service visiting craft. The company is an authorized dealer for Edo floats.

* * *

Stanley C. Boynton of the Seaplane Service, operating out of Rockland, Me., to the islands of Penobscot Bay and along the coast of Maine, began operations April 15. The scheduled line to Vinalhaven, North Haven, Stonington and Dark Harbor will begin with two round trips daily. Charter work is carried on to all the Maine Lakes and coastal towns.

Plans for expansion are in progress for a larger number of trips and a greater scope territory for the coming season. This year the company plans to operate from Portland to Bar Harbor. It now has a Fairchild 71 and plans to acquire another Fairchild and a Sikorsky amphibion.

Improvements

Within a year the extension of the runway facilities of the Chicago Municipal Airport will be a reality, and the airport will be able to handle the four-engined planes the airlines expect to put into service. A mile long N-S runway will be one of the accomplishments of the project when it is completed.

The Chicago & Western Indiana Railroad has announced its willingness to cooperate fully with the city in its plans for developing the airport. It will relocate its tracks, which now cut directly through the center of the square mile of land controlled by the airport, and of which only approximately half is now being used on account of its division by the belt line tracks.

The estimated cost varies from $300,000 to $800,000 according to the final plan of relocation of the railroad tracks selected.

* * *

A 5-year plan for development of the municipal airport at Lincoln, Neb., has been adopted by the local Chamber of Commerce. Initial steps in the program to be completed this year include improvement and extension of the N-S and E-W runways along with addition of a NE-SW runway.

* * *

An option has been taken on 80 acres of land north of the Pocatello, Idaho, airport by the city council in a program to improve the flying field. A N-S runway, an administration building, hangar and concrete aprons are included in the project.

* * *

The Gooding, Idaho field will be improved to the extent of $6,036, including leveling, installing runway and landing area markers and graveling part of the road to the airport.

New Airports

Congressional plans of converting the Sand Point naval air station at Seattle into a major seaplane base have caused Seattle's city council to acquire 38 acres immediately south of the site for a municipal base. New officers' homes will be built as well as barracks, hangars and perhaps a new bomb-proof hangar under a hill overlooking the field.

* * *

The Ord, Neb., Chamber of Commerce has appointed a committee of three to plan the establishment of a municipal airport on a tract of land adjacent to the city.

* * *

Chesapeake, Ohio, has been approved as the site for the Huntington - Ironton - Chesapeake airport, to serve the cities of Huntington, W. Va., Ironton, and Chesapeake, Ohio. Improvements are to cost between $100,000 and $150,000.

* * *

Plans for a new Ogden, Utah municipal airport are being considered by A. W. Stephenson, National Parks Airways officials, and city officials, who feel that the present airport is too small. A tentative site north of the city, comprising about 365 acres, has been approved by Mayor Harman W. Peery and others.

* * *

Work has begun on the Provo, Utah municipal airport project, estimated to cost $48,000. The new airport embraces 116 acres of land on which two runways, each almost 4000 ft. long, and a brick hangar measuring about 80 × 100 ft. are being built.

* * *

Selman Field, at Monroe, La., is to be improved to the extent of $60,000 with $27,000 being spent for a runway 100 × 3,000 ft. The field is operated by Delta Air Lines, operators of the air mail route between Dallas-Birmingham and Atlanta.

Personnel Notes

Joe E. Lawther and W. B. Marsh have been elected president and vice-president respectively, of the Love Field Company of Dallas for 1936. M. C. Ellison is secretary and Gilbert H. Irish is counsel. Directors are: T. M. Cullum, E. N. Noyes, George W. Loudermilk, S. S. Mallinson, W. B. Marsh, Joe E. Lawther and Gilbert H. Irish.

* * *

John K. Lapp, chairman of the Erie, N. Y. County Board of Supervisors, has appointed a committee of supervisors to determine the necessity for developing an airport on Grand Island. The committee includes Ervin A. Lapp, Arthur J. Adler, John J. Bieler, Fred Hammer and Ross Brown.

* * *

Kenneth Brooks flew a new Taylor Cub out of Bradford, Pa., bound for Riverside, Calif., where he will operate the local airport and act as dealer for the Cub in Riverside.

Bond Issues

Sale of $50,000 of bonds to finance Minneapolis' share of a federal aid project to construct hard-surface runways at Wold-Chamberlain field, municipal airport, has been voted by the Board of Estimate and Taxation. The issue is contingent upon the city's receiving the federal aid. Total cost of the project will be about $250,000.

* * *

Bidding jointly C. H. Little & Co., and Cumberland Securities Co., of Nashville and Knoxville purchased a $25,000 bond issue for a stadium and airport at Bristol, Tenn.

Equipment Required

Construction of the long-projected Calabouco Airport in Rio de Janeiro which, it is claimed, will be one of the finest in the world, has been advanced to the point where consideration is being given to the equipment that will be installed. Those responsible for this undertaking have requested that American airport equipment firms make available descriptive material, prices, and all details regarding any and all equipment used at the most modern American airports. Specifically, price and descriptive data are requested on meteorological equipment, radio, light and traffic control, weighing machines, special motor trucks for supplying fuel, oil, air, etc. to planes, fire-fighting equipment, first-aid articles, and any other equipment that falls in this general category. Interested American firms may secure from the Automotive - Aeronautics Trade Division the name and address of the Brazilian government official to whom they should write in this connection.

Dealer Activities

On March 1 Leech Aircraft, Inc., opened a sales office in Hangar F, Roosevelt Field, Garden City, N. Y., and took over the Stinson distributorship. Henry Schiebel was made sales manager and will work from the Roosevelt Field office; Spencer Leech will divide his time between the office and the Armonk Airport, and J. E. Jones will remain in charge at the Armonk office of the company.

* * *

Texas Fairchild Sales Corp., Fairchild distributors in Texas, recently moved into new offices at the Houston Municipal Airport and changed its name to Air Activities, Inc. The firm is now equipped to handle repairs to airplanes, engines, and radio. In addition, they offer flight instruction, charter and passenger trips, and aerial survey or aerial photographic work.

New Firms

Kargl Aerial Surveys, of San Antonio, has been incorporated by Gilard Kargl, Jack Ammann and A. J. Maxwell.

* * *

Capital Air Line, Inc., has been organized at Boise, Ida., to operate an intrastate service between Boise, Twin Falls, Burley and Pocatello. Daily service is planned, with passengers, express and freight accommodations. C. P. King, C. A. Gregory and Thomas J. Jones, Jr., all of Boise, have incorporated the company with a capital stock of $50,000.

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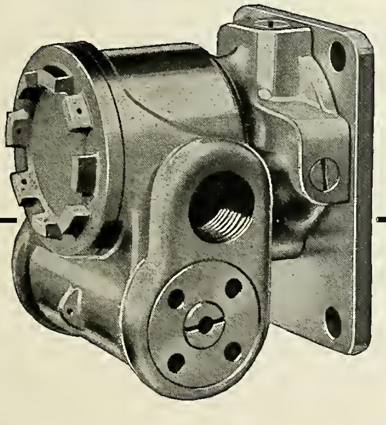

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THE INDUSTRY IN GENERAL

●

Business Reports

Lockheed Aircraft Corp. showed a net profit of $217,986.37 during the fiscal twelve months ended December 31, 1935, it was revealed in the financial report issued recently by Robert E. Gross, president-treasurer. Gains made during 1935 compare with a loss of $190,891.39 during 1934.

* * *

Deliveries of Waco aircraft during the last half-year in 1935 reached a net volume of $945,000, a figure above the entire 1934 net sales.

* * *

United Air Lines Transport Corp. passenger and cargo revenue during 1935 was $8,283,100.52, an increase of 22% as compared to 1934. The company operated with a net loss of $1,392.81 in 1935 contrasted to $2,283,525.31 in 1934.

* * *

Plans for reorganization and incorporation of Columbia Airlines, the feeder air transportation service operating through Cincinnati, from Detroit to St. Louis, have been announced by Thomas L. Johnson, traffic manager. Capitalized at $154,000 when it was started in August, the company soon will be capitalized at $500,000. Harry McGee, Cincinnati, former army officer and chief test pilot for Ford, was appointed operations manager.

* * *

Sales of the Curtiss-Wright Corp., for the year 1935 amounted to $11,119,581 which resulted in a net profit from operations of $2,886.12 after deductions for depreciation and amortization of $587,029.37. Sales in 1934 were $14,009,533.03 and the net profit from operations that year were $359,736.

On March 13, 1936 unfilled orders on hand amounted to $12,523,242 compared to the $7,791,512 for the similar period in 1935.

* * *

Vice President Ray P. Whitman of the Bell Aircraft Corp., announced the augmenting of its staff by more than 20 persons to speed up production of an $800,000 order for wing panels awarded to it by Consolidated Aircraft Corp. Mr. Whitman said operations at the plant will increase until mid-summer, when they will be at their peak. More than 150 men now are employed there and more will be added, Mr. Whitman said, possibly reaching a total of 500.

The men given employment are former employees of Consolidated Aircraft Corp., who remained in Buffalo when the company moved its plant to San Diego last fall.

* * *

The consolidated statement of the Boeing Airplane Company and its subsidiaries, Boeing Aircraft Co., The Stearman Aircraft Co., and Boeing Aircraft of Canada showed sales and other income totaling $1,257,166.86 in 1935, as compared to cost of sales, operating expenses and deductions of $1,590,966.48, showing a net loss of $333,799.62. It was pointed out, however, that unfilled orders amounted to $6,141,203.23 as of December 31, 1935, compared with unfilled orders of only $774,242.82 at the start of 1935. It also was stated that the average monthly loss during 1935, ascribed to the small amount of business on hand, was about half that reported in the previous year.

Errata

In the April issue of Aero Digest, the three-view drawings of the North American NA-16-2 and the Seversky Pursuit (page 114) were transposed in position.

The Lambert Clipped Wing Monocoupe which is now in production under license from the Dept. of Commerce, was inadvertently omitted. Except for changes in the wing and for increased performance, this plane is basically similar to the Monocoupe. (Page 78.)

Foreign License

Arrangements have been made by Menasco Manufacturing Co. to license Phillips-Powis Aircraft Co., Ltd., of England, the second largest British manufacturer of airplanes, for the manufacture of Menasco aircraft engines in England through a subsidiary which will be formed.

First year requirements for Phillips-Powis will be in the neighborhood of 100 engines, and tentative arrangements have been made to furnish these from Los Angeles, which would entail an expenditure of about $150,000.

Factory Expansion

Preliminary bids are now being received for the immediate expansion of the Ryan Aeronautical factory. T. Claude Ryan, president, states that plans call for additional building space that will triple present factory floor area. The new buildings will be adjacent to the company's present factory units on Lindbergh Field. Approximately $50,000 is to be spent in new equipment.

* * *

Boeing Aircraft Co. has announced plans for expansion with purchase of a 28-acre site adjacent to Boeing Field, Seattle. According to C. L. Egtvedt, president and general manager, an assembly building will be completed before the end of the year, with other additions to be made as business warrants.

* * *

Consolidated Aircraft Corp. will increase its Lindbergh Field plant at San Diego by 200,000 sq. ft. starting immediately. This will about double the present factory size. New buildings and machinery to be installed will cost more than $800,000.

Menasco-powered Hammond Model Y recently approved

February Exports

The value of American aeronautical products exported during February, 1936 reached $1,161,224 when 35 planes and 38 engines together with parachutes, parts and accessories were shipped to purchasers abroad. February, 1935 shipments totaled $972,986 with 21 planes and 22 engines accounting for the bulk of the shipments at that time.

The 35 aircraft brought $582,613 and the engines $149,743. Parachute sales brought $1018 while parts and accessories returned $427,850.

Sales of planes in Siam exceeded those of any other country during February when 11 units were exported. Four planes went to England, and a similar number to Peru; two (each) were shipped to Australia, Union of South Africa, Honduras and Trinidad and Tobago. One plane was sent to Chile, Colombia, Netherland India, Canada, Costa Rica, Mexico and Hawaii.

Eight engines were shipped to England and other engines were imported by purchasers in Brazil (6), Finland and Bolivia (4 each), Argentina, Australia, Panama and Trinidad and Tobago (2 each), and French West Indies, China, Netherland India, Italy, Costa Rica, Honduras, Hawaii and Mexico (1 each).

Japanese purchasers bought the greatest amount of parts and accessories in February, exports to that country amounting to $155,275.

Small Planes Lead

An increase of approximately 34% in the number of light airplanes of the private owner type manufactured in the United States in 1935 is shown in Department of Commerce aircraft production figures for 1935.

The total of all aircraft produced continues the upward trend which commenced in 1934. Previous to that year production totals shrunk from 6193 in 1929 to 1324 in 1933. The total for 1934 rose to 1615 and in 1935 it was 1691.

The increase is particularly noticeable in small civilian airplanes of the types suitable for private owners. The greatest increase in this classification occurred in the number of one and two-place cabin land monoplanes produced. In 1934 there were 120 manufactured while 460 were constructed in 1935. The number of three-place cabin land monoplanes increased from 54 in 1934 to 83 in 1935.

Of the total production in 1935, 1079 aircraft were for domestic civil use, 317 were for delivery to military establishments, and 295 were exported.

(*Continued on following page*)

SIKORSKY *Chooses Streamlines* FOR THE NEW S-43

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- Inter-Island Airways chooses the combination of Sikorsky and Streamline Tires to maintain its reputation for faultless service. A reputation so widely recognized that no trip to Hawaii is considered complete without a flight with Inter-Island Airways.
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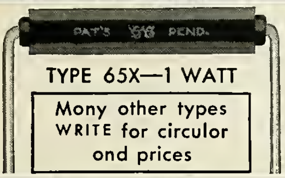

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AVIATION GASOLINE
AVIATION ENGINE OIL
ROCKER ARM GREASE

(*Continued from preceding page*)

14,806 Pilots

There were 14,806 pilots and 7,205 aircraft holding active Department of Commerce licenses on April 1, 1936, according to the Bureau of Air Commerce, Department of Commerce. On April 1, 1935 there were 13,886 licensed pilots and 6,855 licensed aircraft.

The total number of aircraft, licensed and unlicensed, of which the Department had record on April 1, 1936 was 8,887, while this number on the corresponding day of last year was 8,805. Unlicensed aircraft (bearing identification numbers only) totaled 1,682 on the first of April 1936.

Among the 14,806 persons holding pilots' licenses as of April 1, 1936 were 7,144 transport, 842 limited commercial, 6,085 private, 733 amateur and 2 industrial pilots. Licensed pilots included 404 women, classified as follows: transport, 69; limited commercial, 25; private 262; and amateur, 48.

Sales

An order for two carloads of Berryloid aircraft finishes has been received from the Consolidated Aircraft Corp., according to T. B. Colby, vice-president and head of the aircraft division of Berry Brothers, Inc., Detroit, Michigan. These finishes are to be used on Navy flying boats. The order is one of the largest received by Berry Brothers from an aircraft contractor in recent years—totalling 75,000 pounds by weight.

* * *

Pratt & Whitney Aircraft Division of United Aircraft Corp., received an order from United Air Lines for twenty-six Twin Wasp engines rated at 1000 hp. and capable of delivering 1160 hp. These engines, the most powerful yet acquired by any domestic airline in the United States, will power ten new Douglas DC-3 transports, which are now being built for United Air Lines.

* * *

Receipt of orders for a fleet of four new Wright Whirlwind powered Electra airliners, costing $50,000 each, to be delivered to Chicago and Southern Air Lines, Inc., of St. Louis, has been announced by Lockheed Aircraft Corp. The planes go into service May 1.

* * *

Superior Oil Producing Co., Houston, Texas, has purchased an executive model Lockheed Electra transport.

* * *

A Fairchild 24 powered with a 145 hp. Warner Super Scarab engine was shipped to T. Stewart MacLeod, who is forming an organization to serve as agent of the Fairchild Aircraft Corp., in England and India, with headquarters at Heston Airdrome, England.

* * *

During a recent week sixteen new Cubs left the Taylor Aircraft factory in Bradford, Penna., five going to Aircraft Associates and dealers in southern California.

* * *

Bellanca Aircraft Corp. has delivered a Senior Skyrocket to the Des Moines *Register & Tribune*. This airplane takes the place of the Pacemaker formerly owned by the newspaper, and which was traded in on the 1936 Senior Skyrocket.

Wideroe's Flyveselskap, A/S, of Oslo, Norway, have placed a 1936 Senior Pacemaker 7-place transport in operation on their newly opened contract air mail and passenger service inaugurated from Oslo.

* * *

Beckwith Havens and Richard H. Depew, Jr., Fairchild distributors at Roosevelt Field, sold a Ranger powered Fairchild "24" to J. H. Scott, of Pittsburgh, Pa., and a Warner powered "24" to C. S. Robinson, of Ithaca, N. Y.

* * *

Recent Ryan S-T sales include a second 125 hp. model for Franklin Farrel, Jr., of New Haven, Conn., and a special single seater, long range type for Joe Thorne of Tucson, Ariz.

* * *

Six tri-motored Ford transport planes, formerly operated by American Airlines, Inc., will be exported according to T. J. Dunnion, vice-president and treasurer of the company. Three have been purchased by the Colombian government, two others will be used to train students of the Central Aviation School in Shanghai, China, and the sixth will fly the commercial route of "Empresa Nacional de Aeros" in Costa Rica.

* * *

Since the first of the year, 12 Monocoupes have been sold by the Lambert Aircraft Corp. Recent deliveries of the model 90A DeLuxe were to Gunther Wallen, Armonk Airport, N. Y.; Wm. Collier, Tulsa, Okla.; Miss Annette Gipson, New York, N. Y.; Dr. Kingsely, Hastings, Neb.; Knight Culver, Columbus, O.; Frank Cordova, New York; H. C. Moore, Dayton, O. and P. B. Pringle, Santa Monica, Calif.

* * *

St. Louis Flying Service of Robertson, Mo., has delivered a new Fairchild 24 to Dr. Foote of Hastings, Neb.

* * *

American Airlines, Inc., has let contracts for the purchase of about 7,000,000 gallons of fuel. These contracts, according to C. R. Smith, president, are in addition to existing commitments for more than a million gallons of fuel and represent, together, an increase of approximately 30 percent over the past year.

Shell Petroleum Corp., with an order for 3,000,000 gallons of gasoline, is the largest single contractor, Smith said, and another 2,000,000 gallons will be supplied by Socony-Vacuum Company, Inc. A third contract, with Standard Oil Company of New Jersey, calls for 1,200,000 gallons, while other commitments have been placed with other companies in localized territories.

Offices Moved

Haskelite Manufacturing Corp., manufacturers of Haskelite plywood, moved their New York offices to Room 513-B, the Chrysler Building.

(*Continued on following page*)

Digest of Recent Events

Glider Towed Four Miles Above Earth

A new method of studying the substratosphere by a glider train was successfully demonstrated over Moscow. The gliders were provided with enclosed cabins, and carried barographs, wind gauges and other scientific equipment. In these tests, the gliders attained altitudes considerably greater than the towing plane, the first in line going more than 5000 ft. above the plane, and the second in line going almost 5000 ft. higher than the first glider, and attaining an altitude of about four miles. APRIL 3

Hawaiian Clipper Flown To California Via Miami

The Martin flying boat *Hawaiian Clipper*, largest of the trans-Pacific flying boats for Pan American Airways, was delivered to her owners after a 3-stage flight from the factory in Baltimore. The first leg, between Baltimore and Miami took 7 hours 35 minutes for the 1050 miles; the next leg was between Miami and Acapulco, Mexico, while the final flight brought the plane to San Francisco. This leg, 1600 miles, took 13 hours. The entire flight was under the command of Capt. Edwin C. Musick. APRIL 9

Zeppelin Makes Round-Trip Flight Across Atlantic

The new LZ 129 dirigible, christened the *Hindenburg*, left Friedrichshafen March 31 on its maiden voyage across the ocean and arrived in Rio de Janeiro on April 4. The return flight was started on April 6, and after encountering difficulty with two of the four engines, the ship made a successful landing at her home port. The ship covered 12,756 miles at an average speed of 60 mph during the flight, but because of the circumstances surrounding the return voyage, a better record is expected. APRIL 10

Sikorsky Amphibion Breaks Altitude Records

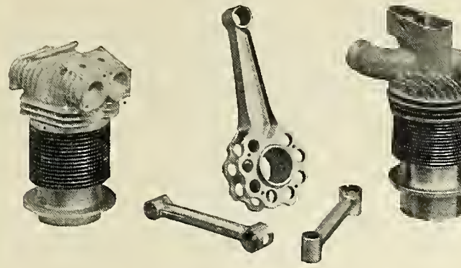
Two new altitude records were established when Capt. Boris Sergievsky, with Igor Sikorsky as passenger, and Michael Pravikoff, mechanic, climbed a Sikorsky S-43 amphibion to an indicated height of 27,950 feet over Stratford, Conn. Sergievsky carried a 500 kilogram payload in the P & W powered twin-engined plane. The records he established, however, did not add to the list of world's records owned by the U.S., inasmuch as both former records were held by Americans. APRIL 14

Musick, Earhart Win Harmon Trophy

For his pioneering work in conjunction with Pan American Airways' trans-Pacific service, Capt. Edwin C. Musick was awarded the Harmon Trophy for 1935. Amelia Earhart was designated the leading American woman pilot, and with Jean Batten, the Englishwoman, will share the world award for women. APRIL 17

Hughes Sets New Miami-New York Mark

Flying the same Wright Cyclone-powered Northrop in which he set a transcontinental record, Howard Hughes lowered the flying time from Miami to New York when he negotiated the 1196 miles in 4 hours 21 minutes 32 seconds. The previous record, set by the late Jimmy Wedell at 5 hours 1 minute 39 seconds, was between New York and Miami. Hughes took off from the Pan American Airport, climbed to 13,750 feet, and between Jacksonville and Savannah averaged 290 mph. The landing was made at Floyd Bennett Field, Brooklyn, New York. APRIL 21



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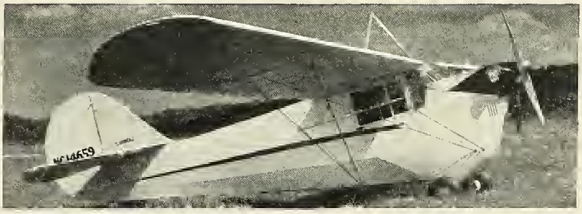
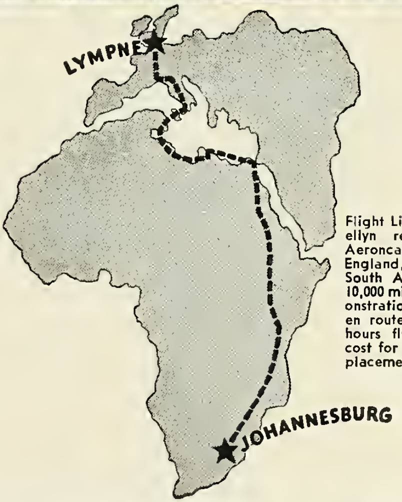
AERONCA'S Ten Thousand Mile Flight SETS 3 MORE RECORDS!

Aeronca C-3





Flight Lieutenant D. Llewellyn recently flew an Aeronca C-3 from Lympne, England, to Johannesburg, South Africa—a total of 10,000 miles, with 36 "demonstration stops" made en route. A total of 130 hours flying time. Total cost for fuel $130. No replacements or overhauls.

AGAIN Aeronca demonstrates its leadership in the light plane field. Here again is indisputable proof of outstanding performance and reliability under all kinds of flying conditions—desert heat, extreme cold, three hours of flying blind over the Mediterranean, flight over uncharted jungle areas, landings, and take-offs from small, unprepared fields.

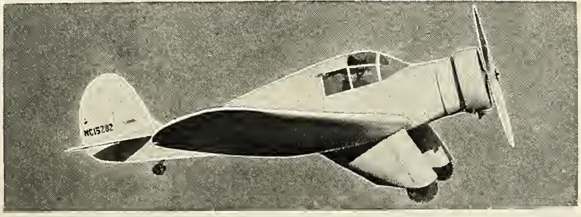
Incidentally, three new "firsts" for light planes were set, (1) first jump from England to Africa; (2) longest flight for light planes; and (3) two 600-mile non-stop hops.

Write for further details about this "wonder ship" today.

AERONAUTICAL CORPORATION OF AMERICA
LUNKEN AIRPORT CINCINNATI, OHIO

AERONCA

Aeronca Low Wing



(Continued from preceding page)

Sales Subsidiary

Fairchild Aviation, Inc. has been organized as a subsidiary of Fairchild Aviation Corp. to handle all export and some domestic sales of Fairchild products.

The new company will handle export sales of Fairchild three and five-place airplanes, of aerial cameras and the Kruesi Radio Compass, and both foreign and domestic sales of the Ranger aircraft engines and of Fairchild transport airplanes.

Ernest Robinson, president of the Fairchild Aerial Camera Corp., is also president of the new subsidiary.

Air Races

Because an extensive improvement program is under way at the Cleveland Municipal Airport, it may be necessary to hold the 1936 National Air Races at another field.

The races have been concentrated in a 3-day program extending from Sept. 5 to 7. The tentative program includes three races and one parachute competition on each of the three days. The Bendix Transcontinental is scheduled to finish during the first day, and the Thompson Trophy race will be held on Labor Day.

Personnel Changes

Promotion of J. A. Williams from sales manager to assistant to the vice-president and general manager of the Curtiss Aeroplane & Motor Co., Inc., was announced recently by Burdette S. Wright, vice-president and general manager of the Buffalo plant.

* * *

C. G. Taylor, designer of the original Taylor Cub, and associated with the Taylor Aircraft Company for five years as president and general manager, is now forming a new organization at Butler, Pa., to go into early production on a new light plane which he has designed and built.

* * *

Earl F. Ward has been appointed airway traffic control supervisor by the Bureau of Air Commerce, Department of Commerce. His work will be to provide for orderly and safe movement of airplanes along the Federal airways and in and out of major air terminals. Specifically, he will be in complete charge of airway traffic control work of the Bureau which will include: The preparation of initial rules and regulations governing airway traffic; subsequent necessary revisions and modifications; supervision of all personnel engaged for the purpose of controlling airway traffic; establishment of a licensing method for control tower operators at airports and general supervision of the personnel engaged in the latter work.

* * *

Announcement of the addition to the executive staff of the Bendix Aviation Corp., of Harry L. Bill, was made by Vincent Bendix. Bill will make his headquarters at The Pioneer Instrument Co., Inc., Brooklyn, N. Y.

* * *

Fred Rohr has been appointed to the position of factory superintendent for the Ryan Aeronautical Co. He will be in direct charge of the manufacturing of the Ryan S-T planes and will also act as supervising instructor for Ryan students whose courses include metal fabrication work.

* * *

C. Russell Warren, formerly head of the Chicago Branch of L. C. Chase & Co., Inc., has been appointed sales manager for all Goodall Sanford transportation and homefurnishings divisions, and Charles E. Holden has been appointed head of the Velmo furniture fabrics department.

* * *

George I. Fischer has joined the Technical Division of the Algoma Plywood & Veneer Co., as engineer, and in the sales promotion and advertising departments.

M. K. Erdmann, of the Taylor Aircraft Co., who has made many contacts in New York and New England during the past year has been transferred to Atlanta, Ga., as Southeastern zone manager.

PERSONAIRLITIES

(Continued from page 54)

while had got to the point where they were chewing pieces out of the furniture when final word came from Freeburg: "Landed on Wabasha Field. Everybody and everything safe. Waiting for relief ship so that we may continue." Another ship was sent down to Wabasha, and Freeburg took off again with his original load of passengers and arrived in Chicago with them only 58 minutes late. What's more, when he got to Chicago he still had the same three engines he'd left Wabasha with. A year later, under somewhat similar circumstances, on a Westbound trip, Freeburg landed safely at La Crosse, Wisconsin. By now he's used to it.

Knowing a good many experienced airline pilots, I am never surprised into turning handsprings when one of them gets his passengers down safely even under such trying circumstances; it's what I expect of the whole lot of them, if the airplane itself gives them the slightest chance. You take any of our experienced first pilots, and when something like that happens you can count on them to keep cool and to do the best that is humanly possible. If the plane will still fly, they'll fly it down. But to me the amazing part of this story is the fact that Freeburg almost instantly radioed his operations office. Questioned regarding this, he replied after much hesitation, "In all major air accidents where the crew and passengers were killed, the cause had remained an unsolved mystery. If this accident had come to such a conclusion they would at least have known what caused it, and that knowledge would be of value in the future progress of aviation."

Now just imagine a pilot in the position that Freeburg was in thinking of the future progress of aviation! There's coolness and headwork for you! If I had ever found myself in such a precarious position, not only would I have failed to call up, but if the operations people had called me I'd have replied, "Line busy! Hang up until after I find out who's elected." And I wouldn't be referring to Roosevelt, Landon, or Borah, either.

Coming Events

Spring Aviation Day will be observed at the Springfield, O., municipal airport. May 17.

●

Empire Air Day will be observed in England. May 23.

●

An International Aero Exhibition will be held in Stockholm, Sweden. May 16-June 1.

●

The Annual Display of the R.A.F. Flying Club will be held in England. June 6.

●

The 1936 Missouri State Air Tour, sponsored by the Lambert-St. Louis Airport Ass'n., will start from St. Louis. June 12-14.

●

An air pageant will be staged at Wold-Chamberlain Field, Minneapolis, Minn., Paul Burwell, chairman. June 12-14.

●

The Second Annual Intercollegiate Air Meet, under the auspices of the Intercollegiate Flying Club, will be staged at the Wayne County Airport, Detroit. June 19-20.

●

The Eighth Annual Indiana Air Tour, under the auspices of the Indiana Aircraft Trades Ass'n, will start from and end at Indianapolis. June 22-28.

●

The Royal Air Force Display will take place at Hendon, England. June 27.

●

The Seventh Annual Soaring Contest will be held at Elmira, N. Y. under the auspices of the Soaring Society of America. June 20-July 5.

●

The King's Cup Air Race will be held in England. July 10-11.

●

The Coupe Armand Esders speed race will be held over a route between Deauville and Cannes, France. July 25.

●

An Aviation display and aerobatic competition will be held at Templehoff Airport, Berlin, Germany in conjunction with the Olympic Games. July 31.

●

A gliding demonstration, international in character, in conjunction with the Olympic Games will be given at Templehoff Airport, Berlin. Demonstrations also will be given at the Wasserkupke. Aug. 4.

●

1936 National Air Races; site indefinite. Sept. 5-7.

●

The Deutsche de la Meurthe Cup Race, under the auspices of the Aero Club of France will start from the Etampes Montdésir Airport. Sept. 13.

●

A 7060-mile round-trip speed and handicap race between Paris and Saigon, and sponsored by the Aero Club of France, will start from an airport near Paris. Oct. 25.

●

An International Aviation Show will be held at the Grand Palais, Paris. Nov. 13-29.

●

15th International Aeronautical Salon is scheduled to be opened at Grand Palais, Paris, November 12-29.

●

The National Air Transportation Show, under the auspices of Aviators' Post 743, American Legion, will be held at the Grand Central Palace, N. Y., N. Y. Jan. 28-Feb. 6, 1937.

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FOREIGN NEWS IN BRIEF

Australasia

It is intended to replace much of the present radio equipment of the Royal Australian Air Force by modern telephone apparatus, having wider range. The new apparatus will enable conversation between the occupants of a plane and headquarters up to a distance of several hundred miles, while consideration is also being given to the installation of direction-finding equipment in various parts of Australia, depending to a large extent on the ground organization to be provided for civil aircraft.

G. A. Robinson, Managing Director of Airlines of Australia, has returned from America, where he completed the purchase of three Stinson Airliners. The first of these arrived in Sydney on March 17 and will be used on the Sydney-Brisbane run. Tentative schedules show a 90-minute reduction in operating time with the new equipment.

The first annual report of the Butler Air Transport Co., operating the Cootamundra-Charleville section of the Empire air mail route, shows that more than 70,000 miles were flown, and more than 25 tons of letters, in addition to passengers and freight carried.

The Federal Cabinet is not in agreement with proposals of the British Government that all first-class mail between Australia and England should be carried next year by British machines conducting an Empire air mail service, instead of the subsidized shipping services. The cabinet decided to retain Australian control of the service from Sydney to Singapore, and to impose a surcharge on air mail letters, but decided to inform the British Government that the Commonwealth would in 1937 be prepared to introduce an improved and accelerated service with high speed aircraft twice weekly between Sydney and Singapore.

It is anticipated that next year all first class mails between capital cities will be carried by air on a daily service. In this year's budget there is provision for an expenditure of £100,000 for preliminary ground organization for the inter-capital service, and it is expected that there will be another £200,000 in the 1936-7 budget.

The cost of operating the air service by which letters will be carried without surcharge is estimated to be $180,000 a year.

Air France will extend its Marseille-Hanoi line to Canton. This line will be connected with the Peking-Shanghai-Canton and the Changtu-Hankow-Shanghai lines of The China National Aviation Corp.

Qantas Empire Airways, Ltd., reports a total of 444,822 miles flown on the Brisbane-Singapore service, involving more than 100 crossings of the Timor Sea, during the first year's operation of the Australian end of the Imperial air mail route. DH86 aircraft were used exclusively on the 4361 miles between Brisbane and Singapore.

Eastern Air Transport, Ltd., made a survey flight in preparation for regular service between Sydney, Junee and Cootamundra, the service to be extended to Wagga as soon as an airport is available there. The company will use Avro 10's and plans to operate four round trips a week.

In order to operate an air taxi service, James Melrose has ordered a Heston Phoenix four-passenger plane.

The British Government announced weekly air mail service between London, and Nigeria and the Gold Coast. The mail is carried as far as Khartoum on the London-South African service; there it is picked up by the air service operating to Kano, Nigeria. For the present, the mail will be transported overland from Kano to Lagos (Nigeria) and Accra (Gold Coast). First flights on this service started February 9.

Canada

A new air mail route, the first for 1936, was opened on April 15 between Kenora and Machin, Ontario. Like other routes out of this northwestern Ontario town, the new route gives service to points not receiving other regular mail service.

Prospectors Airways Co., Ltd., one of the few companies still in existence which combine aerial exploration of minerals with actual operation of mines, reports a loss of $49,075 (including depreciation on airplanes) for 1935. The company is engaged in work in Quebec, Ontario and Manitoba, and has active mines as well as an aerial exploratory branch.

Canada's freight and express tonnage was almost doubled in 1935 over that of the previous year, according to a statement of Minister of Defence Mackenzie. Canadian airway operators carried 26,439,224 lbs. of freight and express in 1935, compared to 14,441,179 lbs. in the previous record year, 1934. Passenger traffic also increased from 105,306 to 177,472. Practically all traffic is north of the railway lines, in what were a few years ago the barren lands of Canada. Mines, fur posts, missions and new settlements receive the bulk of Canada's air traffic.

Canada's aviation appropriations tabled in Parliament for the coming fiscal year amounted to $5,801,100, of which $4,130,000 is for the R.C.A.F., and $1,262,800 for civil aviation. An increase of over half a million dollars in the latter's appropriations allows for the completion of emergency landing fields on the trans-Canada airway between Winnipeg and Vancouver. A million dollar increase in the Air Force appropriation enables Canada's air defence service to be put back to its 1932 basis and for the purchase of new planes.

Japanese Kawasaki A6 military communication plane powered by a 600 h.p. B.M.W. engine

Canada's flying clubs will receive new trainers from the government, and an order has been placed with Fleet Aircraft Corp., at Fort Erie, for eight such planes.

The 22 Canadian light flying clubs flew a total of 13,819 hours during 1936, figures which were only surpassed in 1929 and 1930, when the membership was far higher than the present total of 2,400. The clubs had 81 planes in use during the year and 536 members under instruction. Members obtained 165 private pilot licenses and 33 commercial licenses.

At the end of 1935 there were in the Dominion 396 licensed private pilots, 414 commercial pilots and 472 air engineers. Airplanes totalled 44 private, 336 commercial and there were 96 airharbors actively in use.

W. M. Archibald, of Kaslo, B. C. was awarded the McKee J. Dalzell Trophy. Mr. Archibald as a flying school conductor, made the most valuable contribution to flying during the year, in the opinion of the award committee. He first learned to fly in 1929 and during 1935 he had 450 hours' flying time.

Much of his flying has been done under difficult conditions prevalent in the Rocky Mountains. He was responsible for the inauguration of the air services of the Consolidated Mining and Smelting Co., to assist their mining activities in northern Canada.

China

The best annual record for commercial aviation in China was made in 1935. In that year, China National Aviation Corp. carried 10,400 passengers, compared with 5,224 passengers in 1934. It added two 14-passenger and three 10-passenger planes to its fleet. The number of round trips per week on the upper Yangtze services were increased and fares were reduced. Regular services were operated at the end of the year between Shanghai and Canton, via coast ports; between Shanghai and Peiping, via Nanking and Tsingtao; between Shanghai and Chungking and Chengtu, via Yangtze River ports and between Chungking and Yunnanfu, via Kweichow. The Eurasia Aviation Corp. discontinued the unproductive Canton-Hankow-Peiping service, but added a number of planes to the service between Shanghai and Chengtu via Chengchow and Sianfu and maintained its Shanghai-Chengchow-Sianfu-Lanchow service.

(Continued on following page)

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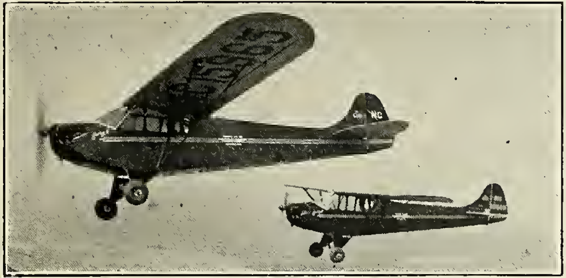

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Fokker D.21 single seat fighter. Powered by a Bristol Mercury engine, maximum speed is 250 m.p.h.

(Continued from preceding page)

Czechoslovakia

As a result of negotiations between Czechoslovak Air Traffic Co., and foreign transport companies it is expected that the foreign service offered by the former will be speeded up. The first step in this direction will be on the Prague - Munich - Zurich - Geneva-Marseille route (771 miles) which will be flown in 6 hours 43 minutes including stops. The new schedule will make it possible to travel from Prague to Madrid (1362 miles) in 10 hours 45 minutes as against 50 to 57 hours taken by express trains.

France

The French Aeronautical Chamber announced that the next International Aviation Show will be held in Paris at the Grand Palais from November 13 to 29. Sections of the show will be devoted to heavier-than-aircraft, lighter-than-aircraft, engines and propellers, air navigation, science, electrical, photography, hydrogliders and marine accessories, metallurgy and raw materials, machine tools and industrial equipment, transportation materials and hangars.

Aeromaritime, a subsidiary of Les Chargeurs Réunis, will operate an airline between Dakar and Pointe-Noire (Africa) for a period of five years. No subsidy is to be granted by the Government. A Sikorsky S-38 amphibion plane will be used for test flights, but the line is to be operated with Sikorsky S-43s.

Maryse Bastié, present holder of distance records for light planes, is preparing to attempt to wrest the feminine record for a South Atlantic crossing from Jean Batten. Mlle. Bastié recently crossed the South Atlantic aboard the regular airmail flying boat of Air France in order to study the conditions of the flight. She plans to make her attempt in a Caudron Simoun.

Marcel Déat has been appointed Minister for Air in the new Cabinet. He replaces General Denain.

Henri Mignet, inventor of the *Pou-du-Ciel,* has flown his two new models, a new two-place and an improved model of his first type *Pou-Bébé* (Baby Louse). The latter has a wing span of 13 ft., a length of 9.8 ft. and weighs empty 220 lbs. It is powered by an Ava 32 h.p. engine.

A new type of variable camber wing, developed by Jacques Gérin and called the *Varivol,* was tested in the wind tunnel at Chalais-Meudon. The system allows a ratio of 1:4 between the minimum and maximum areas.

A new flashing rotating beacon with a range of about 50 miles has just been installed at Le Bourget airport, which has also been equipped with a second radiogoniometer.

The nine-cylinder radial Potez 9 A.B.R. geared engine has been tested in the laboratory at Chalais-Meudon with a view to obtaining a license. It delivers 220 h.p. at 2500 r.p.m. The same type direct drive engine delivers 185 h.p. at 2100 r.p.m.

The French West African governing council has approved the project of connecting Dakar to Gao by an airline which would pass through Tambacounda, Kayes, Bamako, Segou and Mopsi.

Air France and Compagnie Générale Transatlantique (French Line) are forming a provisional organization for the purpose of studying the possibilities of an airline across the North Atlantic, and with a view to establishing a joint operating company in the future.

After the Air Ministry opened bids for the reconstruction and modernization of Le Bourget airport, General Denain, the then Air Minister, approved the project presented by Mr. Labro. Work, the cost of which will amount to eight million francs, is to be started immediately. Its execution will take 16 months, the new airport being opened upon the occasion of the International Exposition of Paris in 1937. Beside the reconstruction of buildings, the plan provides for an enlargement of the field to twice its present size.

The numerous successful crossings of the South Atlantic in 1935 influenced Air France to inaugurate weekly both-way service on January 5. Under these conditions the time of postal transport from Europe will be as follows: to Brazil, 2 days; Argentine-Uruguay, 3 days; Chile, 4 days; and Peru 6 days.

Great Britain

The Eaton Mfg. Co., through its new English subsidiary, British Aero Components, Ltd., has begun production of sodium cooled valves and other precision engine parts at its recently established plant in Coventry, England. The plant will serve the British aircraft and automotive industries and will be in full swing within a few weeks. Installation of precision equipment required for manufacture of valves and hydraulic tappets under license from the Wilcox-Rich division of Eaton is now almost complete.

Nearly fifty Royal Air Force stations will be opened to the public in all parts of Great Britain and at Aldergrove in Northern Ireland on May 23, to celebrate Empire Air Day.

Holland

The newest Fokker contribution to military aircraft is the D.21 single seat fighter powered by a Bristol Mercury VI S engine. This design embodies several new features of a military-technical nature which heretofore have not been achieved. With the Mercury engine, the plane has a maximum speed in excess of 250 m.p.h., but powered by a Hispano-Suiza engine, maximum speed is expected to be 280 m.p.h. Specifications of the plane show a wing span of 36.1 ft.; overall length 23.6 ft.; wing area 172 ft.^{2}; empty weight 2700 lbs., useful load 1160 lbs., gross weight 2860 lbs.; wing loading 22.4 lbs./ft.^{2}; power loading 6 lbs./hp.

Latin America

Two passenger and mail services have been started by Cia. Lineas Aereas Mineras, S. A. One operates between Durango City and Mazatlan, and the other from Mazatlan to La Paz, Lower California. Service is thrice weekly.

Landing fields have been established at Tenancingo, Mexico State; Ciudad Guzman, Jalisco; and Celaya, Guanajuato. Fields are under construction at Valle Alvarez, Colima, and Mitla, Oazaca. A larger and more modern passenger station and administration building is being completed at Mexico City's central civil airport.

A company of Americans and Mexicans is being organized to operate passenger, mail and express service between Chihuahua and Sonora. E. Johnson is to be managing director and will headquarter at Tonichi, Sonora. Three planes have been bought for the service which will contact only towns remote from railroads and other transportation routes.

Cia. Aeronautica del Sur, S. A., has applied to the Ministry of Communications and Public Works for a permanent concession for its services in southern Mexico between Villahermosa, Cardenas, Cunduacan and Huimanguillo, Villahermosa, Salto de Agua and Macuspano, and Villahermosa and Alvaro Oregon.

The new Pan American Airways' air passenger station at Harbour Head, Jamaica is a conservative and attractively designed building of Caribbean colonial design, similar to the terminal erected at Nassau by the company last spring.

Accommodations in the new building provide for passengers, mail and express and for government offices necessary in connection with international operations. Other new facilities at the base include new refueling equipment provided with modern rapid electric pumps.

A separate building has been constructed to house the reserve electric light and power plant and the gasoline pumps.

Poles have been erected in connection with the radio communications station, drives and parking spaces provided, and a covered path approximately 100 ft. long extended from the station to the pier to protect arriving and departing passengers from the weather.

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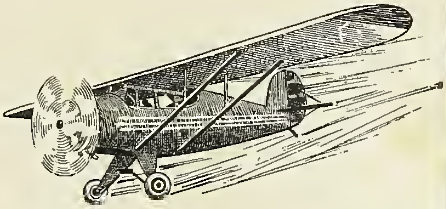

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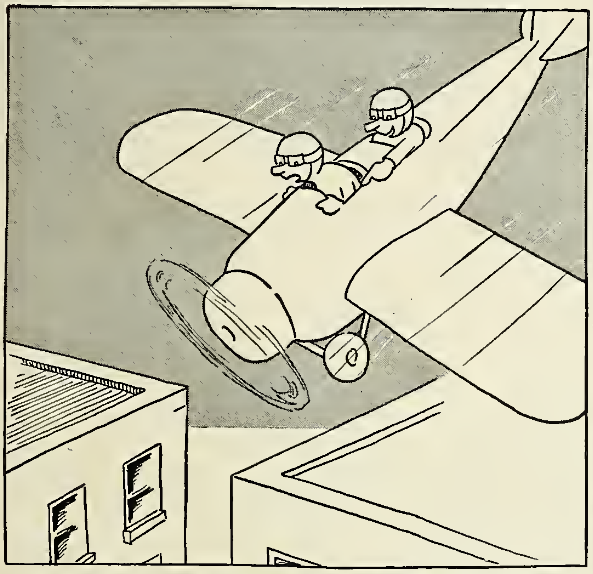

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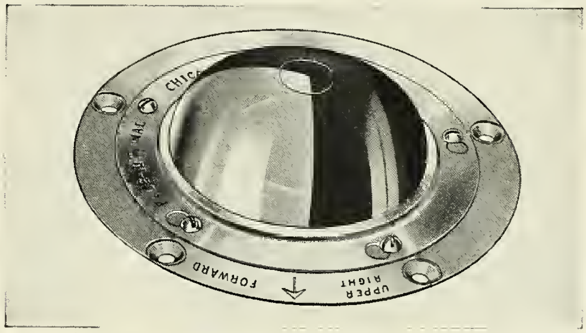

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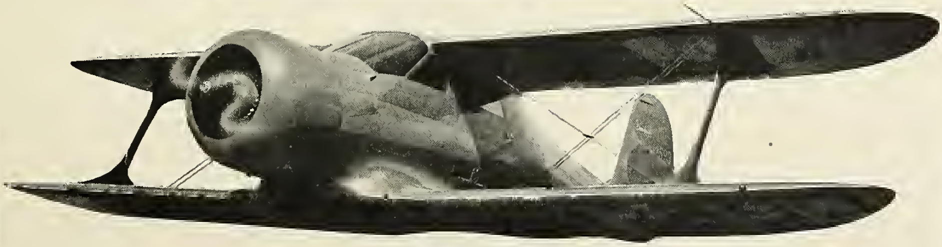

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ALICE IN LOONEYLAND

(Continued from page 20)

aviation, particularly our transport phase of it, is to progress, then these additional aids are absolutely necessary to make it safe."

"It is not alone a question as to whether they progress or not, is it?" asked the Senator.

"Yes, sir," said Mr. Vidal.

"Is it not necessary," the Senator queried, "to have safety for those lines now in existence?"

"That is not exactly the right slant on it," Mr. Vidal amazingly remarked, while everyone gasped. "We find that we have 8,000 miles of routes on which air lines are flying with mail contracts, which routes have no aids, and in the last 2 years there have been no fatal passenger accidents on those routes."

The Senator, who has a logical mind, immediately remarked, "Then your idea is we can do away with all of these devices?"

"No, sir," said Mr. Vidal, doing another gymnastic trick inside his head, "those lines cannot perform satisfactorily in maintaining schedules."

"I think it's very thoughtful of them to cancel in bad weather and not kill any passengers," Alice remarked to the Rabbit.

"You mean they cannot fly regularly?" asked a gentleman whom the Rabbit identified as Senator O'Mahoney.

"Yes, sir," replied Mr. Vidal, "I mean they cannot fly regularly, but they can fly safely, on account of the fact that they can only fly in good weather."

"According to Mr. Vidal, then," said Alice to her companion, "we have two kinds of airlines here: one kind that cannot fly regularly, but can fly safely; and another kind that can fly regularly, but cannot fly safely."

"Let me ask you this," said Senator O'Mahoney, "Is the radio equipment which we now have adequate to the night and storm schedules that we have?"

"It is not adequate," Mr. Vidal admitted, "to complete the schedules that they should complete."

"What does he mean by that?" asked Alice.

"Apparently," whispered the Rabbit, "he means the Bureau of Air Commerce radio equipment was not adequate to complete the schedules of those planes that crashed before they completed the scheduled trip to their scheduled destination."

"I am not quite satisfied with your answer, Mr. Vidal," said Senator Copeland. "You mean to say that under present flying conditions aviation is as safe as it ought to be?"

"It depends entirely, Senator, upon the type of weather they fly," replied Mr. Vidal.

"I always thought it did," Alice murmured to the White Rabbit.

"That is to say, if you do not fly any planes at all, it is perfectly safe?" queried Senator Copeland.

"No, sir," said Mr. Vidal.

"Mr. Vidal," said Senator Copeland with almost medical professional gentleness, "are you afraid that if you make a complete answer that it will be a reflection on you?"

"No, sir," said Mr. Vidal feebly.

"Then are you satisfied with the aids you have at present?" queried Senator Copeland.

"No, sir; no, sir;" moaned the trembling Vidal, "I should say not."

"You are not?"

"No, sir; I am not." Mr. Vidal was quite positive about it.

"In the interests of safety in the air, do you need more aids?" the Senator inquired.

"In order to fly bad weather; yes, sir," said Vidal.

"You see," the White Rabbit whispered to Alice, "the necessary money to buy these aids had been refused by the Budget. So many billions had been handed out for Happy Harry Hopkins' Boondoggling Varieties Show by the Roosevelt-Farley boodle gang that there wasn't enough left to give the Bureau of Air Commerce a mere 5 millions for safety in the air."

"Then the Duchess is not to blame for this condition of no safety on the airways?" asked Alice.

"Not entirely," replied the White Rabbit. "He didn't get the money, and without money he couldn't buy modern equipment—even if Rex Martin, his radio expert, could tell the difference between radio equipment and a mechanical device for stuffing sausages."

"It's odd, though," remarked Alice, "that the Duchess should be so eager about a 'safe' $700 airplane when the radio equipment that cost millions was unsafe."

"What is the relative safety," inquired Senator O'Mahoney, "between these large transport planes and the smaller planes that were used some time ago?"

"The airline equipment is far safer and more efficient than ever before," replied Mr. Vidal. "In fact, the airlines' development and progress has been remarkable during the last few years, and it has gone far ahead of European air transport developments."

"And these new planes are actually the last word in transportation," said Senator O'Mahoney.

"The last word, yes, sir, today," Mr. Vidal agreed. "Now, Senator Copeland was exactly right when he said that with this rapid development in airline operations—and particularly the technique of flying—the air aids have not kept pace. There is not any question about that." "We have radio installations," admitted Mr. Vidal, "that are 7 or 8 years old, and they compare in efficiency with a home radio of 7 or 8 years ago."

"I wonder if the airline passengers know that as they relax in our luxurious airliners," Alice wondered.

"Which are actually the last word in transportation," added the White Rabbit, "as Senator O'Mahoney said."

"But I don't see any safety in having safe airliners if you have unsafe Government airways for them to fly over," remarked Alice.

"I am not interested in the airlines," said Senator Copeland. "I am interested in the American people who use the airlines. I want the record to show, if it is the truth, that we are not properly equipped to make it safe in the air as the airlines are operated."

"That is correct," admitted Mr. Vidal.

"That is true, isn't it?" persisted the Senator.

"Yes, sir," said Mr. Vidal.

"And what a sweet one that is for the record!" exclaimed Alice.

"You said it!" the White Rabbit agreed. "There's nothing to be added when the Director of Air Commerce himself admits that we are not properly equipped to make it safe in the air as the airlines are operated.

"If the present operating conditions are unsafe," mused Alice, "why does Mr. Vidal, who is in charge of those conditions, permit the airlines to operate under them?"

"Colonel Gorrell is here, Mr. Chairman," remarked Senator Copeland. "He is the head now—the czar, so to speak—of the aviation industry, and I am sure that it needed a czar."

"Colonel," said Senator Copeland, "I take it that you have seen this outline of needs as stated by the Department of Commerce. Are you in favor of these things? Are they essential, in your judgment?"

"Sir," replied Mr. Gorrell earnestly, "they mean life and death."

"He means Rex Martin's 8-year-old radio aids," whispered the White Rabbit.

"Then as they haven't got them," said Alice, "I suppose the answer must be death in some cases."

"So I learn from the newspapers," replied the White Rabbit.

"Colonel, I do not quite want to leave the matter there," said Senator Copeland. "It was clearly indicated to our committee that by reason of the lack of money and sufficient inspections, in consequence many of these safety devices are not operating as they should; that they are off line. That may possibly be the case with reference to the Cutting death, deviation of line there from a defect in proper alignment at the station. So these are things which I want to speak of perhaps more strongly than Colonel Gorrell would feel free to do."

(Continued on following page)

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(Continued from preceding page)

"I like Senator Copeland," said Alice.

"I am satisfied," said Senator Copeland, "that the Cutting disaster could have been prevented if we had had all of the equipment and the use of the equipment that we should have had."

"The TWA crash in Missouri,, you know," remarked the White Rabbit. "Senator Copeland's committee still is investigating it—but apparently the Senator is already convinced that—but I mustn't anticipate him."

"We are holding ourselves responsible to the American people," Senator Copeland continued earnestly, "so far as our part is concerned, for the safety of aviation. I say frankly from what I have learned in the last few months, that I am satisfied we are not doing our part."

"Then Senator Copeland is apparently convinced that the Bureau of Air Commerce was at fault in that TWA crash?" Alice asked the White Rabbit.

"He hasn't actually said so," the Rabbit replied, "but that's how I'm guessing right now."

"We had testimony of a case," Senator Copeland continued, "where a man had started from Miami going north to Jacksonville and on farther north. He ran into storms, turned around, thought he was following the right beam, and found himself over the Gulf of Mexico. It has not been fully determined to our satisfaction why there was such a deviation of that beam, but certainly somebody must find it out.

"That is the reason why I said, a little while ago, that we have got to have one of two things: Either provide these ground devices and make certain that we are safe, or else ground the planes and not operate them at all, because we cannot afford to let the American people travel without giving every assurance of safety in their protection."

"I agree with you, Senator," said Senator O'Mahoney.

"I thank Senator Copeland for his statement," said Colonel Gorrell.

"So do I," whispered Alice.

"Me too," the White Rabbit added.

"The situation is this, Senator," said Mr. Gorrell, "we leave the ground sometimes in good weather, and after we are up, the weather strikes us. We do not know it is there until we get up!"

"But what about the weather reporting service!" said Alice to the White Rabbit. "Does he mean to say that the weather is all a mystery until the plane actually gets into it?"

"That," said the White Rabbit with a sob, "is exactly what he did say. Let's get out of here. I want to go to New York and ride on the safe smelly subway."

With a low moan the White Rabbit stumbled out of the room, followed by Alice, and burst out of doors. Frantically he hailed a passing taxi and clambered aboard. "The station!" he cried. "Hurry."

"The airline station?" the driver asked.

"No, while the Democrats are in, the railroad station."

* * *

Editorial Note: The remarks of Alice and the White Rabbit are of course fiction—though founded upon aviation fact. The statements attributed to Senators Copeland and O'Mahoney, to Hon. J. M. Johnson, Assistant Secretary of Commerce, to Mr. Eugene Vidal, Director of the Bureau of Air Commerce, and to Mr. Edgar S. Gorrell while appearing to be fiction were actually made by those gentlemen at the Hearings before the Subcommittee of the Committee on Appropriations, United States Senate, on H.R.12098. The complete testimony was printed for the use of the Committee on Appropriations, and a copy may be secured from the United States Government Printing Office at Washington.

AIRLINES ANNIVERSARY

(Continued from page 38)

Albany to Rochester, Buffalo, Toronto and Cleveland.

In the spring of 1928 the base at Hadley Field was transferred to the Municipal Airport at Newark, N. J.

In March, 1929, a group of N. Y. financiers began gathering together various small lines throughout the United States under the name of The Aviation Corporation. These lines included Colonial Air Transport, Inc., and its subsidiaries Colonial Western and Canadian Colonial, Universal Aviation Corp., and Embry-Riddle which had operated a 270-mile route between Chicago and Cincinnati since December 17, 1927.

Meanwhile other companies which eventually were to become part of a coordinated and vast airline system were getting under way. Robertson Aircraft Corp. operated CAM 2 between St. Louis and Chicago via Springfield and Peoria. During the period from April 15, 1926 (when service was inaugurated) to December 1 of the same year, 376 trips were made. After inaugurating a St. Louis-Kansas City route early in 1928, Robertson was merged with Universal Aviation Corp., an organization which began operating between Cleveland and Chicago on September 15 of that year. Continuing as a unit of Universal, Robertson inaugurated a 600-mile service between St. Louis and New Orleans on April 27, 1930 and later added to its schedules, CAM 28, a 404-mile run between Omaha and St. Louis. Simultaneous with the acquisition of Robertson, Universal also took over Northern Air Lines, a company flying passengers and express between Fargo, the Twin Cities and Duluth. Subsequently, on June 14, 1929, Universal opened one of the first coast-to-coast air-rail services, working in conjunction with the New York Central and Santa Fe railroads.

Embry-Riddle began operating CAM 24, a 270-mile route between Chicago and Cincinnati on December 17, 1927, while Texas Air Transport made its first flights in the same year when it received contracts covering CAM 21 and 22, between Dallas and San Antonio and between Dallas and Galveston. In 1928, however, Texas Air Transport was merged with Southern Air Transport, an organization which operated three passenger routes totaling 1334 miles and four mail routes totaling 1634 miles.

Southern Air Transport continued absorbing airline companies with the acquisition of Gulf Air Lines, operators of CAM 23 between New Orleans and Atlanta and of CAM 29 between New Orleans and Houston.

Operating during this time was Thompson Aeronautical Corp. which inaugurated CAM 27 between Bay City and Chicago and in 1929 offered the first trans-lake service between Cleveland and Detroit. Interstate Airlines, Inc., had started operations in 1928 over CAM 30 between Chicago and Atlanta and Martz Air Lines was operating a passenger service between Newark and Wilkes-Barre, eventually extending its activities to Buffalo.

These were the lines that the Aviation Corp. took over in addition to Continental Airlines, which flew a 339-mile route between Cleveland and Louisville inaugurated August 1, 1928. The next step was the coordination of these lines into five operating units under the names of Southern Air Transport, Inc., Colonial Air Transport, Inc., Interstate Airlines, Inc., Universal Aviation Corp., and Embry-Riddle Company, each of which functioned individually under the Aviation Corp. until January 1930, when they were combined into a new operating subsidiary known as American Airways, Inc.

In 1933 the Cord Corporation assumed control of the Aviation Corp. Main offices were moved from New York to the municipal airport in Chicago, where all executive and auxiliary activities are conducted. However, with the cancellation of the air mail contracts in 1934, the company's name was changed to American Airlines and the transport activities of the company were divorced from the manufacturing activities of the Cord Corp. to adhere to the new air mail law.

Today American Airlines is one of the largest airline systems in the United States, covering the country from coast to coast and Canada to Mexico. During its ten years of operation, it has flown more than 200,000,000 passenger miles and carried 750,000 passengers. In the eighteen months ending January 1936, it flew

(Continued on following page)

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4.	Aircraft Power Plants	*Jones, Insley Caldwell, Kohr*	1926	4.25	**2.13**
5.	Aircraft Radio	*Eddy*	1931	4.50	**2.25**
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13.	Beginning of Organized Air Power	*Spaight*	1927	7.00	**3.50**
14.	Camp Site Guide—Airplane Landings		1923	1.00	**.50**
15.	Cases on Air Law (2nd Ed.)	*Zollman*	1930	6.00	**3.00**
16.	Conquerors of the Sky	*Frency*	1932	1.00	**.50**
17.	Dynamics of Engine & Shaft	*Roots*	1932	3.50	**1.75**
18.	Elementary Aeronautical Science	*Hart*	1924	2.50	**1.25**
19.	Elements of Aviation	*Clark*	1928	3.00	**1.50**
20.	Everybody's Aviation Guide	*Page*	1928	2.00	**1.00**
21.	Flying the Arctic	*Wilkins*	1928	$2.50	**$1.25**
22.	India by Air		1927	2.50	**1.25**
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26.	Law of Aviation	*Fixel*	1927	7.50	**3.75**
28.	Man & Weather	*McAdie*	1926	2.00	**1.00**
29.	Materials of Aircraft Construction	*Hill*	1934	5.00	**2.50**
30.	Men Working	*Beasley*	1931	3.00	**1.50**
31.	Pressure Airships	*Blakemore & Pagon*	1927	8.00	**4.00**
32.	Principles of Flight	*Stalker*	1931	6.00	**3.00**
33.	Pseudo-Security	*Spaight*	1928	5.00	**2.50**
34.	Sailing the Skies	*Ross*	1931	2.50	**1.25**
35.	Seaplane Solo	*Chichester*	1934	2.50	**1.25**
36.	Skycraft	*Post*	1930	3.50	**1.75**
37.	Skyward	*Byrd*	1928	3.50	**1.75**
38.	Skyways	*Mitchell*	1930	1.50	**.75**
40.	The Book of the Sky	*Luckiesh*	1933	3.00	**1.50**
41.	The Far Horizon	*Lanier*	1933	2.75	**1.38**
42.	The Ingenious Dr. Franklin	*Goodman*	1931	3.00	**1.50**
43.	The Red Juggernaut	*Maxwell*	1932	1.00	**.50**
44.	The Story of Aircraft	*Fraser*	1933	2.50	**1.25**
45.	U. S. Aviation Reports for 1931		1932	10.00	**5.00**
46.	Up	*Gray*	1931	3.00	**1.50**
47.	Wonder Book of Aircraft	*Golding*	(8th Ed.)	2.75	**1.38**
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(*Continued from preceding page*)

86,603,000 passenger miles and carried 246,000 passengers.

Under the presidency of C. R. Smith, who in the early days was with Southern Air Transport, the company is forging steadily ahead. It was largely through American Airlines that the new Douglas DST sleeper transports were designed and constructed. These planes will shortly go into service between New York and Chicago on a non-stop schedule and later on the Southern Transcontinental route and between New York and Boston. Before this year is out, American Airlines will have Douglas equipment on all its major routes, and tri-motored Stinson Airliners on the shorter routes.

From the brief history of these pioneer airlines it is logical to expect that the coming year holds even greater promise of advancement and the advent of four-engined liners already projected for 1938 should prove as long a step forward in future aerial transport as the advance made in the past decade.

BRITISH MILITARY PLANES

(*Continued from page 23*)

ley Page *Bomber Transport*, a high wing cantilever monoplane with two Siddeley Tiger radial air-cooled engines of 760 hp. A crew of 4 and 30 armed troops may be accommodated. As a bomber, it will carry a total weight of 4000 lbs. at 170-180 m.p.h. There are three removable tanks of 175 gallons capacity each.

The Bristol 130 is another experimental model with two 750 hp. Pegasus engines. The fuselage is of the monocoque type and the wings all-metal. As a bomber, it carries a crew of four, while a crew of 3 and 24 armed troops may be carried at more than 185 m.p.h. The gun position is open in the extreme tail and a turret is placed in the nose with a zipper fastener through which the gun works. Provisions have been made for substituting two 920 hp. Pegasus X engines for those originally used in this *Bomber Transport*.

Type and Number of Squadrons	Max. Speed (m.p.h.)	Total HP	Weight Loaded (lbs.)
FIGHTERS			
Bulldog (6)	170	450	3490
Demon (7)	202	630	4490
Fury (3)	214	600	3600
Gauntlet (2)	228	735	3950
Nimrod (3)	206	630	4050
Osprey (1)	175	630	4935
DAY BOMBERS			
Hart (11)	184	600	4700
Gordon (5)	175	525	—
Wapiti (6)	140	550	5400
Wallace (2)	158	570	5750
Hardy (1)	170	575	4930
Vincent (1)	142	620	8100
Fairey III F (1)	155	500	—
Overstrand (1)	153	1240	12,000
NIGHT BOMBERS			
Virginia (10)	126	1100	17,600
Heyford (2)	142	1300	16,750
Hanaidi (1)	113	920	—
BOMBER TRANSPORT			
Valentia (3)	140	1160	19,500
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Vildebeest (3)	141	550	8100
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Torpedo-Bombers

The Vickers *Vildebeest* for the army has a 550 hp. Pegasus. It carries a crew of two and may be equipped with twin floats or wheels and has a top speed of 141 m.p.h. at 6,500 ft. and 140 m.p.h. at 10,000 ft. It has a cruising range of 1,250 miles and absolute ceiling of 19,000 ft. Its empty weight is 4230 lbs. and armament consists of one fixed Vickers gun firing through the propeller disc and a Lewis gun aft on a Scarff mount.

The Blackburn *Baffin* for naval service has a 565 hp. Pegasus I M 3 engine, a maximum speed of 136 m.p.h. at 6,500 ft., service ceiling of 15,000 ft., and a 4½-hour endurance at 100 m.p.h. In addition to one fixed gun forward and one aft on a Scarff or Fairey mount, a bomb load of 1500 pounds or one torpedo may be carried. Empty, the plane weighs 4180 lbs.

The Fairey *Swordfish* is a new type now being allocated to the Navy. It has a 655 hp. Pegasus III M and Townend cowling, and carries a crew of three for spotting and reconnaissance and two for torpedo or bombing work. It is equipped for catapulting and carrier deck landing and is armed with one fixed gun forward and one Lewis aft. One 18" torpedo or equivalent load of bombs may be carried.

Ed. Note: Photographs accompanying this article are copyrighted by *Flight* magazine.

(*To be continued*)

ZEPPELIN AIRSHIP

(*Continued from page 43*)

vided for the lubricating oil circulation. These pumps force oil from the crankcase through the cooler to the service oil tank. From here, the main pump sucks the oil through the filter directly in front of the engine into the engine to 8 plunger pumps serving individual bearings. Four Bosch fuel-oil pumps, arranged on the forward end of the engine (one for each four cylinders) are driven by the forward end of the crankshaft. A governor assures correct idling with 16 or with 8 cylinders at low engine speeds.

The LOF-6 is directly reversible, action being effected by shifting the camshaft by compressed air.

Standard Oil Company of New Jersey, contractors to Deutsche Zeppelin Reederei for the diesel oil and hydrogen requirements of the zeppelin during its forthcoming visits has assigned Col. John H. Jouett of the aviation department as one of the company's contacts between the zeppelin operators and the Navy.

A million and a half cu. ft. of hydrogen and 15,000 gal. of diesel fuel will be supplied the zeppelin on each visit, the gas and fuel coming from the Standard Oil's Bayway refinery outside Elizabeth, N. J.

BOOK REVIEWS

PRACTICAL AIR NAVIGATION

By Thoburn C. Lyon

This book covers the essential information for practical air navigation which should be known to anyone who indulges in cross-country flying. The contents cover chart reading, cross-country flying, piloting, air navigation by dead reckoning, radio navigation, practical examples and additional valuable information. The book, which may be obtained from the Director, Coast and Geodetic Survey, Washington, D. C., is well-written, well presented and is a valuable source of readily understandable information.

AUTOMOBILE AND GASOLINE ENGINE ENCYCLOPEDIA

By A. L. Dyke

Dyke's *Automobile and Gasoline Engine Encyclopedia* is a complete volume dealing with the construction, operation, troubles, tests, adjustments and repairs of the automobile and its component parts. The seventeenth edition contains 1,415 pages, 4,600 illustrations and 16,000 lines of index.

Such subjects as automatic choke, automatic clutches, hydraulic automatic valve silencers, front-wheel suspension, knee-action, synchro-mesh transmissions, dual-ratio rear axle, vacuum spark retard, compression effects on fuel, octane selector, stroboscopic ignition timing light, valve seat inserts, exhaust gas analysis, inches of mercury or vacuum testers, etc., which were in the previous edition are retained in the Addenda.

HISTORICAL

A comprehensive, illustrated book, picturing the history and development of aviation from the days of Leonardo da Vinci to the trans-Pacific clipper ships of today, has been issued by Associated Oil Co.

The book, titled *Aviation—Man's Quest for Wings*, contains interesting and pertinent facts about the various types of airplanes, seaplanes and lighter-than-air-craft, their development and their future possibilities.

It includes full page illustrations of the Graf Zeppelin, Orville Wright's first plane, modern transport planes and the transoceanic clippers. In addition there are 28 smaller illustrations of various types of aircraft.

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THE PERSONNEL PROBLEM IN AIRCRAFT MANUFACTURE

(Continued from page 26)

have undoubtedly been effected through this action. Expensive as raw materials are, however, their cost is only a fraction of the sums which are spent on direct labor.

Planning Control Expenditures

If it is practical (and past records have proved it so) to plan and control expenditures for materials, it seems logical to assume that similar planning and control over much greater expenditures would prove advantageous. There are, however, surprisingly few producers who have analyzed the matter in this light. As a result, few steps have been taken to effect savings through the organization of efficient personnel management departments.

The reluctance of aircraft manufacturers to go to the expense of establishing these departments is readily understood, even though the financial advantages of such programs have been unquestionably demonstrated in other cases. The cause is the lack of a financial yardstick with which this activity may be measured. Like the balance sheet entry, "goodwill," it is a valuable asset, but its monetary value is not easily gauged. The only measurement of the success of such a program is an indirect one. It may be estimated by analyzing what proper personnel control can do in bringing about improvements that otherwise would not exist.

Actual Savings

The advantages and savings of a material planning and control program can be definitely determined and accurately expressed in terms of dollars and cents because it is dealing with a real, tangible commodity. Here is a case of a shrewd purchasing agent actually saving several hundred dollars over former identical transactions. Immediately his worth is recognized and every effort made to keep him in the employ of the company. On the other hand, a man in the shop becomes dissatisfied with his work and leaves, or, worse yet, does not leave. How much has that change in attitude cost the company in the same cold, hard American dollars that were used to measure the purchasing agent's efficiency? No method and no individual can accurately measure the loss, but nevertheless a loss has been incurred. Proper personnel control would probably have kept that man on the job and kept him happy in his work. Of course, critics of such work retaliate by saying, "That is all theory; you have no proof." "Anyway you cannot please everybody." True enough. Neither does the engineer, the purchasing agent, the sales manager or anyone else in the organization have a perfect batting average.

Personnel Program Necessary

There are other conditions, which in the past have been inherent to the industry, that make a personnel program indispensable for utmost working efficiency. Unfortunately, activity in most of our aircraft factories has fluctuated during the last five or six years. When the company secured a contract for its product the plant immediately became a beehive of activity. Workers were hired, almost promiscuously, some coming from long distances. In many cases these people have been uprooted from their homes, friends and families. They arrive in a strange town among strange people, hundreds of miles from home, with no interests or activities to occupy their time except a job which takes about 40 out of a possible 168 hours in the week. The answer to that is self-explanatory to most men who have been in similar situations. Unfortunately the answer is not one that most executives like to associate with efficient and careful workmanship.

Personnel Organization

The size of any personnel organization depends upon the scope of its activities and the size of organization it is serving, and may entail the services of one or more individuals. Probably the better course of action for a concern developing such a department would be to start humbly and develop as the organization's scope increases, rather than to set up a cumbersome, top-heavy structure that would be unwieldy and inefficient because of its size.

Too often the terms "personnel" and "employment" are used synonymously. In the true sense of the word employment is only one function of personnel work. In its broader sense the term personnel entails all relations between employee and employer. Today there are several aircraft manufacturers who have personnel directors but unfortunately have little more in the way of a true personnel organization than the name. Frequently the functions of these directors are only in the field of employment. On the other hand it would not be fair to those few organizations that have done noteworthy work in this respect to create the impression that nothing has been or is being done. Such is not the case.

Activities of such an organization depend to a large extent upon the nature of the work being done at any particular time by a given manufacturer. The function and activities of a personnel department should not be any more rigid and set than the product being built. This is continually changing, and the work of the personnel organization should be adjusted to meet these changing manufacturing conditions. A frequent objection to the establishment of this phase of management is that the company feels it is not large enough for so elaborate a set-up. If we consider the problem in the light of the expenditures made in proportion to total production costs, labor control is far more important than material control because it represents a much larger portion of the total cost.

(To be continued next month)

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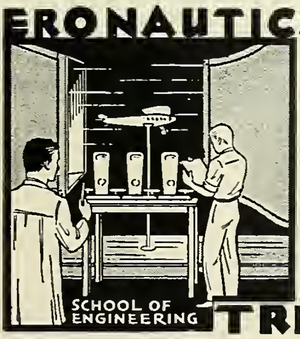

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Lambert

LAMBERT MONOCOUPE: Just relicensed; excellent condition; Townend speed ring; new December 1931; oleo undercarriage; standard instruments; sale price, $1,150. Brayton Flying Service, Robertson, Missouri.

VELIE MONOCOUPE: $495; recovered, relicensed, perfect. Thirty-foot wing. Axle undercarriage. 200 hours logged. Dick Schall, Berwyn, Md. (College Park Airport). Telephone Berwyn 385.

PIONEER OFFERS 1934-35 Deluxe Lambert Monocoupe; full set blind instruments, new style ring, pants, special streamlines, snappy color, $2 200. Terms. Pioneer Aviation, Airport, Syracuse, New York.

MONOCOUPE WARNER 125: Wheel pants, rate of climb, bank and turn, steel propeller. Motor and plane completely overhauled and relicensed. Price $1,250. Lee W. Turner, 1060 Park Avenue, New York, N. Y. Write.

VELIE MONOCOUPE: Licensed. Always hangared. Oleo landing gear. Ship and engine condition excellent. Just majored. Exceptional bargain at $[illegible]65 cash. Wayne Curtis, Butler, South Dakota.

VELIE MONOCOUPE: In perfect condition. Dual controls. $400 cash. Licensed to January 1937. Roy Decker, R. R. 3, Waynesboro, Pennsylvania.

Lockheed

FOR SALE: Wasp Lockheed Vega. Arthur C. Goebel, Phillips Petroleum Company, Bartlesville, Oklahoma.

Loening Amphibions

LOENING AMPHIBION Air-Yacht: 8-place, with spare Cyclone motor, perfect condition. 50 hours since major. Full sea equipment. Licensed, including spare parts. Bargain for quick sale. Spencer Laboratories, Akron, Ohio.

FOR SALE: Loening Commuter 4-place seaplane, less than 200 hours on ship and motor. A. J. Hartman, Burlington, Iowa.

New Standard

FOR SALE: New Standard D-25, J-5; steel prop, tail wheel; time 800 hours; $1,200. New Standard D-25, J-5; ship new, with J-5 total time 80 hours; $2,500. We furnish parts for all model Standards. Wanted: Sikorsky twin-motored. A. L. Matthews, P. O. Box 114, Schenectady, New York.

Pitcairn

J6-9 330 H.P. PITCAIRN Mailwing: This ship is in excellent condition and loaded with instruments. Fully equipped for blind and night flying, electric starter, steel propeller and powered with Wright E-type motor. No time on since major overhaul. Trades accepted or terms if desired. Edw. A. Forner, Jackson, Michigan.

FOR SALE: Pitcairn Mailwing, J-5 motor; 75 hours since majored; airwheels and brakes, newly reconditioned steel prop, speed ring, fabric in excellent condition, fuselage just refinished. A nice flying airplane and a bargain at $1,200. Wire or write Clayton Lemon, P. O. Box 2144, Roanoke, Virginia.

Pitcairn Autogiro

FOR SALE OR TRADE: PA-18 Pitcairn Autogiro, 160 Kinner, 125 hours. Like new. Special cabin enclosure optional. Equipped for banner towing. Cost $6,750. Will sacrifice, $1,975. Consider trade for Waco, Ken-Royce with or without motor. AERO DIGEST, Box 2299.

Porterfield

FOR SALE: 1936 Porterfield, powered with LeBlond 70. Air speed, Townend ring, airwheels, 78 hours total time; never cracked. Bargain at $1,200. Meramec Flying Service, care Steuby's Airport, Highway 66, Valley Park, Missouri.

Ryan

J-5 RYAN: 5-place cabin monoplane; 650 hours, 40 since complete motor overhaul. Direct-gear starter, bank and turn, air speed and all standard instruments; full swivel pneumatic tailwheel, steel propeller, Bendix wheels and brakes. Covering good condition; needs small amount work for relicensing. Best cash offer positively takes ship immediately. G. A. Berry, Ashland, Ohio.

Star

STAR CAVALIER: Engine has 16 hours since major. Recently recovered; hand rubbed fuselage. A real aeroplane. Will trade. Act quick. C. B. Soames, Peru, Indiana.

Stearman

STEARMAN: Model C-3-R; 250 h.p. engine, Wright; 8.50 x 10 semi-airwheels, steel propeller, Lear radio, turn and bank; in excellent condition throughout. Licensed until December 1, 1936. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

Swallow

$395 BUYS OUR licensed Hisso Swallow with steel prop. Louisville Flying Service, Inc., Bowman Field, Louisville, Kentucky.

OX-5 SWALLOW 3POLB: Plane and propeller A-1 condition. Motor just majored. Licensed till March 1937. $385. Ravenswood Airport, Route 1, Des Plaines, Illinois.

Stinson

SM8AB STINSON: Very good linen, blue and red; speed ring, landing lights, standard instruments, semi-air wheels, new tires, 11 hours since major; privately owned, always hangared. $1,675, cash only. Dr. Young, WDGY, Minneapolis, Minnesota.

SPECIAL STINSON MODEL R: Built for executive use, with down cushions, reclining rear seats, whipcord upholstery; total time 378 hours, 108 since engine major overhauled by Lycoming service station; retractable landing lights, bonding, shielding and Lear radio; 75 gallon tanks; color International orange and grey; entire ship rubbed finish. Price, $2,500. G. D. Owsley, Glenview, Illinois.

STINSON MODEL S: $1,875. Radio, blind, night equipped. Pants. Engine modernized, covering A-1. Dick Schall, Berwyn, Md. (College Park Airport). Telephone Berwyn 385.

STINSON JR. (SM7B): Wasp Jr. (300) powered. Ship and engine in A-1 shape and both recently overhauled. Has starter, generator, landing and navigation lights, bank and turn, rate of climb, air temperature, clock, radio, heavy duty battery, extra large fuel tanks, ring, pants, semi-airwheels, etc. Complete details and photograph on request. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

J-5 STINSON: 4-place, licensed December 1936. Motor majored; new wheels, full instruments. $1,000 or trade for Lambert Coupe or Waco C. O. E. Dickerhoof, Chanute, Kansas.

FOR SALE, CHEAP: Late '34 Stinson Custom Reliant, flap job, slightly cracked up. If interested, write Southern Air Services, Inc., Municipal Airport, Memphis, Tennessee.

SIX-PLACE J-5 STINSON: Hand rubbed finish; 35 hours on engine since major overhaul. Good barnstormer. $800. Fast Aero Service, Municipal Airport, Memphis, Tennessee.

PIONEER OFFERS Stinson S, $1,800. Reliant, $3,000. J-5, $1,000. Warner Stinson, $850. Many others. Write or wire for list. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

FOUR-PLACE J-5 STINSON: Licensed to October 1936. In perfect condition. Bargain. Fred Fenn, 24 Lafayette Avenue, Hempstead, L. I., N. Y. Hempstead 4732-W.

1935 RELIANT STINSON: Total hours 250. Equipped with radio, landing lights, large gas tanks and full set of flying instruments. Priced to sell. Can be seen at Aurora Airport. Ted Ilseman, 260 South Highland Avenue, Aurora, Illinois.

BEST LYCOMING STINSON in country. Only 123 hours since complete modernization motor and plane, factory. $1,400 takes her. Details on request. S. L. Huey, Devils Lake, North Dakota.

SNAP BUY: Model S. four-place Lycoming Stinson; needs recovering; electric starter with generator; total time 380 hours. Submit cash offer or your best proposition. Michigan Aero Motors, Jackson, Michigan.

STINSON RELIANT, 1935: Flaps, like new, $3,375. Kinner Eaglerock, just licensed, $700. Monoprep, $425. Taylor Cub, 1935, bargain, $1,050. Bennett Air Service, Hightstown, New Jersey.

Taylor

TAYLOR CUB: New, only 35 hours including ferrying from factory; winter enclosure, compass and maroon fuselage; new condition; sale, $1,250. Brayton Flying Service, Robertson, Mo.

TAYLOR CUB: Model A-40-2; licensed to March 1937. Just like new. $1,200 cash. Alex Janis, 255 Lafayette Avenue, Grand Rapids, Michigan.

TAYLOR CUB: Continental motor; 80 hours. New plane guarantee. May be partly financed. Fairchild 22, Cirrus Hi-Drive. Smith Flying Service, Wyoming Valley Airport, Forty Fort, Pennsylvania.

Travel Air

TRAVEL AIR: 3-place open; J6-7 motor, in excellent condition. 52 hours since complete overhaul. Privately owned, fully equipped. A real buy for $1,400. Shohe Airlines, Boston Municipal Airport, East Boston, Massachusetts.

TRAVEL AIR S-2000: OXX-6; 550 hours, 50 since major; licensed to November 1, 1936; good condition; $400. R. W. Hankins, 15 Westminster Street, Providence, Rhode Island.

TRAVEL AIR J-5: Privately owned, 3POLB. Excellent. 8 hours since majors. Starter, brakes, fuel pump, speed ring, lights, 63 gallons, 14 instruments, Kollsman sensitive, blind flying. Many extras. Beautiful finish. $1,525, quick cash. E. P. Higbee, 2563 Kingston Road, Cleveland Heights, Ohio.

TRAVEL AIR: 3-place, 125 h.p. Full air wheels, Hamilton steel propeller, extra Hartzell propeller, full set engine tools. Licensed September 1936. Excellent condition; reasonable. AERO DIGEST, Box 2291.

HISSO E 180 H. P. TRAVEL AIR: Motor rebuilt; licensed till November. Bendix wheels, brakes. Will trade; will demonstrate to satisfaction. $650. Thomas Lane, Neosho, Missouri.

J6-7 TRAVEL AIR: Cabin, 4-place. Modernized; navigation and landing lights, battery, Sperry compass, clock, new prop. Licensed January 1937. $1,395. Also one J6-7 Hamilton blade. Also mags and plug shields for 9-cylinder engine, $20. D. Crossman, Ridgefield, Connecticut.

PIONEER OFFERS Travel Air J6-5, $950. J-5, $1,000. J-6 cabin, $1,500. Speedwing, $1,250. Many others. Write or wire for list. Terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

TRAVEL AIR 2000: Excellent condition; semi-airwheels, full Miller overhead; total time on ship and motor, 125 hours. Always hangared. Must be seen to be appreciated. Roy S. Clifford, 630 Leith Street, Flint, Michigan.

TRAVEL AIR J-5 SPEEDWING: Like new, just relicensed; tops 150. New covering; never cracked. A real ship. $1,250. John Herner, 933 Franklin Avenue, Brooklyn, New York.

J-5 220 H.P. TYPE B-4000 Travel Air: 3-place. Late outrigger type undercarriage. Bendix wheels and brakes, air tail wheel, excellent condition throughout. Terms if desired. Edw. A. Forner, Jackson, Michigan.

Verville

J6-7 VERVILLE: 4-place de luxe cabin; Dep. control; blind instruments, lights, Wiley flares, starters, speed ring, semi's. Radio. 700 mile cruise burns 10 gallons. Like new, $1,600. Also J6-7 engine, majored; steel prop; 27" x 12" x 5 Airwheels and brakes; make offers. Warner parts, cylinders $25. Cessna wheels, landing V, skid, brake, parts. Merle Buck, Corner Miller & Mills, Madison, Wisconsin.

Waco

WACO J-5: Straightwing. Excellent condition. Semi-air wheels, brakes, speed ring, electric starter, navigation lights and battery. Flexible tube lines. Usual instruments plus rate of climb and turn and bank. Irvin silk parachute, just relicensed. Front cockpit cover. Hinged windshield over pilot's cockpit. Always hangared and privately owned. Reasonable. A. C. Lange, 2544 N. Farwell Ave., Milwaukee, Wisconsin.

OX-5 WACO TEN: New covering; finished with Berryloid; Millerized. Licensed. Big sacrifice at $400 for quick sale, flyaway Garretson, South Dakota. F. C. DeVall, Garretson, South Dakota.

WACO J-5: Motor in excellent condition. All completely recovered, chromium plated struts and wires. Glass windshields. Looks like new. Always hangared. George J. Freres, Muskegon, Michigan.

WACO J-5: Equipped starter, brakes, metal prop, position lights, Aerol landing struts; licensed to September 1936. Asking $1,150. Reasonable cash offers considered. Kenneth Joseph, West Chester, Ohio.

WACO CABIN: Late 1933. 210 Continental. Radio, landing lights, leather upholstery, extra gas tanks, metal propeller, flares, extra instruments, etc. 25 hours since major overhaul of ship and engine. Price $3,500, cash. AERO DIGEST, Box 2284.

FOR SALE: Late model 225 Jacobs standard Waco; fully equipped, wheel pants, radio, Kollsman, etc. Bargain. Never had an owner. Making room for 1936 models. Bennett Aircraft, Inc., Love Field, Dallas, Texas.

WACO LATE '33 CABIN: Guaranteed perfect condition throughout; 150 hours since major and modernization; blind flying equipment and Westport radio, flares, large gasoline tanks, full wing fairing, steel prop, leather upholstery, air brakes; wired for landing lights; all new tires; $2,985, exceptional bargain. Dixie Airways, Shushan Airport, New Orleans, Louisiana.

WACO F WARNER: Excellent condition, motor factory majored. Heywood starter, steel prop, pants, brakes, speed ring, cockpit covers, blind instruments, lights. Relicensed, 2-15-36. Price, $1,450. Gundry, 910 Union Industrial Bank, Flint, Michigan.

WACO F: Just recovered, relicensed. A steal at $1,490. Dick Schall, Berwyn, Md. (College Park Airport). Telephone: Berwyn 385.

WACO C: 1934 De Luxe Cabin, 210 Continental. Total time under 200 hours, 25 since factory top overhaul. Salt-cooled valves. Ship never cracked or damaged; always hangared; vermilion finish throughout; always waxed; equipped with air starter, wheel brakes and air brakes; 70 gal. gas, two Switlik seat pack chutes; flares, landing lights, heavy duty 12 v. battery, Lux CO-2 fire extinguisher, flexible oil and gasoline lines. Prepared for radio. Standard instruments plus: Turn and bank, rate of climb, sensitive altimeter, ball bank, chronometric tachometer, Army drift indicator, Elgin clock, air temperature, carburetor temperature. Sperry directional gyro. Extra Hartzell propeller. Plane and motor in perfect condition, inside and out. $4500. Will send anywhere in U. S. for inspection upon receipt of $1,500 to guarantee pilot's expenses. Lloyd Laflin, 230 North Michigan Avenue, Chicago, Illinois.

WACO: Custom De Luxe; five-place cabin demonstrator, like new. Cost over $7,700. Sacrifice to make room for new models. The H. C. Robbins Company, Cleveland Airport, Cleveland, O.

OXX-6 WACO: Licensed May 1937. Extra good engine. Oversize drop-center tires. Air horn. Cowling like new. $465. Don't write letters; come, see, buy. Airport, Mt. Healthy, Ohio.

WACO OX-5: Never cracked. Gloss finish. Licensed. $385 cash, or will trade for light plane. C. E. May, Box 145, Minneapolis, Minnesota.

WACO INF: 125 Kinner. Recently recovered; 60 hours since major overhaul; ship in beautiful condition; colors, green and black. Standard instruments, including bank and turn. Priced low for quick sale. G. W. McCauley, Aeronautical Radio Company, Roosevelt Field, Mineola, New York.

PIONEER OFFERS Waco F, $1,300; Waco C, $1,800. Waco J6-5, $1,000; J-5, $1,150. Waco 10, $350 up. Better airplanes for less. Terms arranged. Pioneer Aviation, Airport, Syracuse, N. Y.

WACO CABIN JACOBS: '34 model; motor modernized; extras: special 70 gal. gas, landing lights, flares, bank and turn, rate of climb; prepared for radio; air brakes, thermometer, special paint job. The most exceptional buy of the year, at $3,750. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

WACO A. S. O. with only 73 hours since $500 major on J-5 motor and $600 major on airplane. 18-coat high polish finish. Best buy in country for $1,375. We finance and take trades. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO GXE: 217 hours since complete recover and new motor. Air wheels, Scintilla, Millerized. $550, cash. C. Kenneth Hoequist, Route 3, Orlando, Fla.

J-5 WACO STRAIGHTWING: Less engine and propeller. Total time since new, 80:00; no time since completely recovered and finished. Wings and fuselage Stearman vermilion, black stripe. New motor mount; complete new landing gear; brakes, wheels, tires, and tubes; never cracked. Total time certified. Have the pleasure of owning an airplane which is practically brand new. $1,050. Waco 10 GXE: 75:00 hours since completely reconditioned; fuselage finished in hi-lustre blue, wings red; engine 90:00 hours since new; Flottorp prop; price, $450. Waco "A": Late 1933 Jacobs; no time since major. Radio, bank and turn, Heywood starter, wheel pants, speed ring; yellow fuselage, green wings; excellent condition; price, $2,500. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO 5-PLACE CABIN YKS: One year old, 170 hours total time, Jacobs 225 h.p. engine. Standard equipment; like new in every respect. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

FOR SALE: Waco F, Kinner B-5. Starter, lights, $1,250. Want Stinson SM8A or S Stinson. B. F. Hildebrand, Armagh, Pennsylvania.

FOR SALE: J6-5 Straightwing Waco 3POLB; starter, steel prop, semi-airwheels, brakes, Aerol landing gear struts; in good shape; bargain to first buyer. Nicholas Myers, care Airport, Atlantic City, New Jersey.

WACO F: Warner 125 h.p. 128 hours since major. Absolutely perfect. Price $1,475. We finance and take trades. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

JACOBS WACO: 5-place custom, fully equipped including two-way radio and ambulance attachments. Never damaged; selling to replace with new model for demonstrating. Aviation Service Corporation Airport, South Bend, Indiana.

WACO F: Kinner K-5. 60 hours since major. Excellent condition. Price $1,375. We finance and take trades. St. Louis Flying Service, Lambert Field, St. Louis, Missouri.

WACO CABIN: Late 1933, with latest 1934 Continental 210; special paint job and upholstery; wheel pants, flares, landing lights, bank and turn, rate of climb, extra instruments. Just relicensed with general overhaul. Total time under 400 hours. Excellent buy, $3,200. Located New York area. Demonstration upon request. AERO DIGEST, Box 2304.

FOR SALE: 1935 Waco Custom Cabin, excellent condition. Total time 250 hours. Completely reconditioned. Motor 225 h.p. Jacobs, just major overhauled; no time. Ship vermilion, wings silver. Extras: Wheel pants, 70-gallon gas tanks, landing lights, electric flares, turn and bank, manifold pressure gauge, Kollsman compass, Curtiss-Reed prop, radio compass and 3-band receiver. AERO DIGEST, Box 2305.

WACO F: Just recovered and top overhauled; relicensed to April, 1937. 110 hours since major; total 510 hours. One owner since new. Consider trades. $1,490. Bob Kashower, Miramar Apartments, Washington, D. C.

WACO STRAIGHTWING: J6-5-D; modernized. Aerol type struts; wings and tail just recovered. Cash price, $900. Boulevard Airport, Philadelphia, Pa.

Miscellaneous Aircraft

Aeronca, American Eagle, Arrow, Barling, Bellanca, Bird, Buhl, Command-Aire, Curtiss Jr., Robin, Thrush, Driggs, Eaglet, Eaglerock, Fairchild, Fleet, Great Lakes, Heath, Kellett Autogiro, Laird, Lambert, Lincoln Page, Lockheed, Moth, Pitcairn, Pitcairn Autogiro, Porterfield, Rearwin, Ryan, Simplex, Stinson, Taylor, Travel Air, Waco.

SALMSON EAGLET: No time since completely rebuilt. $650. J-5 Travel Air E-4000; 60 hours since completely rebuilt; $1,200. Curtiss Jr. CW-1: Just had top overhaul; $450. All ships licensed. Complete details on request. Charles R. Spaulding, 15 Gates Avenue, Hudson, Massachusetts.

STINSON SM8A: Duals, navigation lights, S landing gear; 850 x 10 tires; fabric excellent; $1,450 cash. Tank Robin: Fabric good, $650. Waldo P. Fuller, 1014 West View Street, Decatur, Illinois.

J-5 4000 TRAVEL AIR: Motor and ship just overhauled and relicensed. Excellent condition. Sacrifice at $1,150. Velie Monocoupe, just refinished. Airwheels. Motor good. $360. Carthage Airways, Carthage, Missouri.

BARLING NB-3: New LeBlond engine; ship time 200 hours; just completely overhauled; recovered and relicensed; painted a snappy yellow and trimmed in black; ship is the classiest NB-3 in the country. $625 or will accept or pay any cash difference on any trades. OX Waco GXE: New engine, air wheels, entire ship perfect condition, licensed; $450 or will trade. S. D. Williams, 699 Garfield, Akron, Ohio.

CHALLENGER ROBIN: Landing, navigation lights; flares, steel prop, new tires, puncture-proof tubes; being relicensed, $1,050. Curtiss Jr.: Engine just major overhauled, $450. Kinner Fleet: Airwheels, steel prop, landing, navigation lights; blind flying hood; following instruments both cockpits: tachometer, rate of climb, sensitive altimeter, bank turn, compass, airspeed; ship rebuilt by approved station; hand rubbed high gloss finish, $2,200. Warner Command-Aire: Airwheels; ship rebuilt and recovered last May; being relicensed; $900. Others. Sell your ship through us. Southern Aircraft Sales, Box 609, Shreveport, Louisiana.

RACING PLANE: Speed better than 200 m.p.h. Cirrus-powered. Good reliable money winner. Priced very reasonably. Harold Neumann, 521 Twenty-seventh Avenue, Moline, Illinois.

ALL METAL CABIN PLANE: Can be purchased by proper buyer; most beautiful ship in America, built by Stinson for research purposes and NR licensed for advertising, etc. Seats four and is low-wing monoplane resembling a small Northrop. Send 50c for photo. Milt Hollman, 2959 Field Avenue, Detroit, Michigan.

Miscellaneous Aircraft *(Cont.)*

REPOSSESSED PLANES OFFERED: A-40-3 Continental Taylor Cub, absolutely like new, $1,200; $300 down. Arrow Sport, $750; $250 down. B-5 Kinner Pitcairn Autogiro, beautiful condition, $1,500; $500 down. 1935 latest type Aeronca, $1,200; $400 down. Buhl Pup, just refinished, $500; $200 down. Balance easy monthly payments. Quick action advised if interested. Aviation Finance Co., Hemlock, New York.

WACO CABIN: 1933, Continental, 520 hours, 15 hours since majored; Hamilton prop, large tanks, radio, landing lights, flares, clock, turn and bank, $3,500. Waco Straightwing: 165 J-6 350 hours since new; 60 hours since modernized; Hamilton prop, starter, turn and bank, rate of climb, $1,500. Travel Air Sport: K-16 Kinner 125; 225 hours since new; Hamilton prop, starter, turn and bank, $1,800. Kellett Autogiro; 210 Continental, total 540 hours, 60 hours since majored; 70 hours since overhaul on overhead. $3,000. Red Bank Airport, Red Bank, New Jersey.

11 CERTIFIED RECONDITIONED Airplanes: Priced to sell. Two J6-9 Stinsons, six-place cabins. Three J-5 Travel Airs. J-5 Straightwing Waco. Driggs Skylark, Rover powered. Two OX Travel Airs stressed for J-5's. Two OX-5 Eaglerocks, one stressed for J-5. Trade in your ship or late model car. Terms if desirable. Write for details. Central Air Service, Grand Rapids, Michigan.

PORTERFIELD: LeBlond 70, demonstrator; perfect. Fleet, Taylor Cub, Kinner K-5 engine, no time since overhaul. Cirrus engine parts. Aero-Ways, Inc., Cleveland Airport, Cleveland, Ohio.

LICENSED GXE-10 WACO: OXX-6, Scintilla mags. 70 hours since majored and recovered; black and cream finish. $550. OX-5 Command-Aire, new Flottorp prop; high lustre red finish, silver wings; good fabric; licensed, $525. Both ships always hangared and in perfect condition. Now at Cleveland Airport. L. Cameron, 1383 Gladys Avenue, Lakewood, Ohio.

HISSO E TRAVEL AIR: $800. Excellent condition; air speed, bank and turn, rate of climb, licensed. Great Lakes 2T1A, $700. H. C. Strickland, Greenbrier, Tennessee.

6-PLACE J-5 STINSON: Excellent condition. Buhl Pup: Wheel pants, fairing, very fast, many extras. Four-place B-5 Bird: Rubbed finish, blind, night and radio equipment. J-5 Laird: Airplane and engine in excellent condition. Indiana Air Service, Airport, South Bend, Indiana.

PITCAIRN PA-20 Autogiro: 125 h.p. Kinner B-5. Condition practically new, special finish, unique performance. Kinner Simplex Red Arrow; 2-place side-by-side midwing. A-1 condition throughout. Motor majored. Wonderful performer. Terms, trades, delivery. Miller Flying Service, Montclair, New Jersey.

ONE FAIRCHILD KR-31: Exceptionally good OX-5 motor, duals; just completely recovered; now being relicensed; $590. One Curtiss Robin: Good OX-5 motor, duals, both ship and motor in exceptionally fine condition; $590. Transport pilot will teach purchasers to fly; guarantee that they can pass flight test for any grade license. Gas, oil, board and room thrown in. Terms, half down. balance when you can fly ship. Beat this offer if you can. John Yilman, Pleasant Gap, Pennsylvania.

200 AIRPLANES, motors, crack-ups: $70 up, terms, trades. Send 25c for Directory giving owners' name, address and price. Acrobatic and Inverted Flying Manual: $1 complete, satisfaction guaranteed. Aircraft Directory, Box 456C5, Athens, Ohio.

SALE OR EXCHANGE: 15 certified airplanes: J-5 Travel Air. J-6 B-5 6-place Ryan cabin ship, airwheels. J6-9 330 h.p. Travel Air cabin ship, full airwheels. 2 Type 2000 OX-5 Travel Airs. I OX-5 Curtiss Robin. 1 Continental A-40 powered Heath. 2 J6-9 and J6-7 Pitcairns, with or without motors, many extras. 2 OX-5 Waco 90's. 1 J-5 B-1 Ryan 5-place cabin ship. Velie Monocoupe. Late model cars taken on deals. Terms to responsible buyers. I Rover-powered Driggs Trainer. I J6-9 Stinson. Airwheels. Becker-Forner Flying Service, Inc., Jackson, Michigan.

HISSO EAGLEROCK: Licensed February '37; ship and motor fully reconditioned February 1936. Many extras. $475; $350 down and terms. Also, J6-7 Curtiss Thrush; sell for $1,250 cash or trade for good Aeronca. Joe Browne, 1054 McBride St., Far Rockaway, New York.

BEST BUYS ON PAGE, less motors: B-5 6-place Ryan cabin ship, full airwheels, less motor. B-I 5-place Ryan cabin ship. full airwheels, with or without J-5 motor, $550 less motor. J6-9 6-place Travel Air cabin ship, airwheels, excellent condition. I J6-7 250 h.p. Pitcairn, airwheels, loaded with instruments. These ships all NC licensed and priced to sell. Michigan Aero Motors, Jackson, Michigan.

KINNER EAGLE: Front exhaust, steel prop, excellent; $900. Ditto, side exhaust, $725. Kinner Monosport, $850. Tank Robin, $750. J-5 Stinson SM1, excellent, $725. Lincoln Page, like new, $450: or trade for Taylor Cub. Ryan B-1 parts, airwheels, 16 x 7 x 3. G. O. Imm, Fergus Falls, Minnesota.

PIONEER OFFERS 1933 Aeronca, $800. 1935 Aeronca, $1,175. 1932, $700. Taylor Cubs, $650 up. Curtiss Jr., $425. Send stamp for list. Terms arranged. Pioneer Aviation, Airport, Syracuse, New York.

WACO J-5 STRAIGHTWING: Air wheels, tail wheel, speed ring. Pitcairn P7-A, J6, complete night flying equipment. Rearwin 185, Challenger: Licensed, excellent. $1,300 each. Lee Sherrick, Canton, Ohio.

TRAVEL AIR E-4000 Speedwing: Cover like new; 100 hours since major; airwheels; exceptionally clean. Bargain, $1,250. Gipsy Moth: Beautiful condition, airwheels, 25 hours since major, $675. Art Neujahr, Bagley, Minnesota.

OX-5 WACO: Scintilla magneto, $450. Velie Monocoupe, $450. Above prices include instructions. Also used Aeroncas as low as $1,000. Radio equipped. Baker-Eberle Aviation Corporation, City Airport, Detroit, Michigan.

FOR SALE: Lockheed Orion, with radio, directional gyro, variable pitch propeller and artificial horizon, $7,500. Lockheed Vega, $4,000. Bellanca Skyrocket, $4,000. Waco F, Warner, 110, $1,450. Blue Bird Air Transport, 5126 West 63rd Street, Chicago, Illinois.

ENGINES

Cirrus, Kinner, Lambert,
LeBlond, Warner, Wright.

FOR SALE, REASONABLE: LeBlond 5-D 60 h.p. motor; complete or any part. Also many extra parts. For information, write V. F. MacDonald, 11646 Mack Avenue, Detroit, Michigan.

J6-7E: Serial No. 13855, no time since top overhaul by Wright station. Cylinders sand blasted, new rings, new harness, etc. Reasonably priced. B-5 Kinner: 265 hours total, none since major overhaul, $350. Warner 125: 575 hours total, including one hour since major, $450. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

WARNER ENGINE: 7 cylinders, 125 h.p. Just majored by Air Associates. $485. Lambert 90 h.p. engine, total time 50 hours, $285. Ray Acre, 5300 W. 63rd Street, Chicago, Illinois.

KINNER K-5: Brand new, with exhaust collector ring. Two 7.50 x 10 Autofan wheels with tires and tubes. P. O. Box 38, Ypsilanti, Michigan.

1935 WRIGHT WHIRLWIND J6-7. 75 hours total certified time. Location: Wright factory, disassembled for inspection. Factory guarantee. A new engine at a large saving. AERO DIGEST, Box 2276.

FOR SALE: At closing out bargain prices: J6-5 175 h.p. Wright motor, $200. J-4 220 h.p. motor, $195. J6-7 250 h.p. Wright motor, $850. J6-9 E-type Wright motor, no time since overhaul, $1,500. J6-7 E-type 250 h.p. Wright motor, $1,250. Steel propellers and electric starter for Wright motors. All Warner and Wright motor parts, 60% to 80% off. B-1 5-place Ryan cabin ship, less J-5 motor, $675. We are closing out. Write or wire your needs. Michigan Aero Motors, Jackson, Michigan.

BRAND NEW English Cirrus Mark II motor: In original crate, as came from factory, $250. Also used Mark III motor, good condition; $75. D. M. Kellam, Weirwood, Virginia.

MISCELLANEOUS SERVICES OPPORTUNITIES, OFFERS, ETC.

MEN OVER 21 YEARS of age interested in parachute jumping from balloons. Contracts furnished. Expert field instructions. Must have $400 cash to buy equipment, etc. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois.

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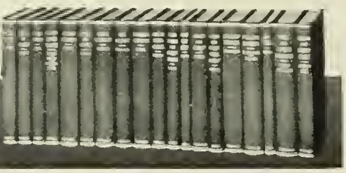

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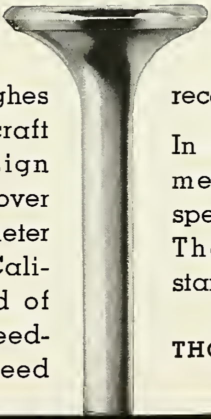

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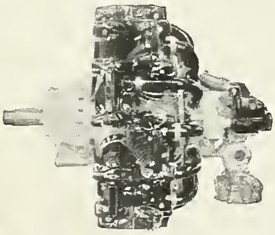

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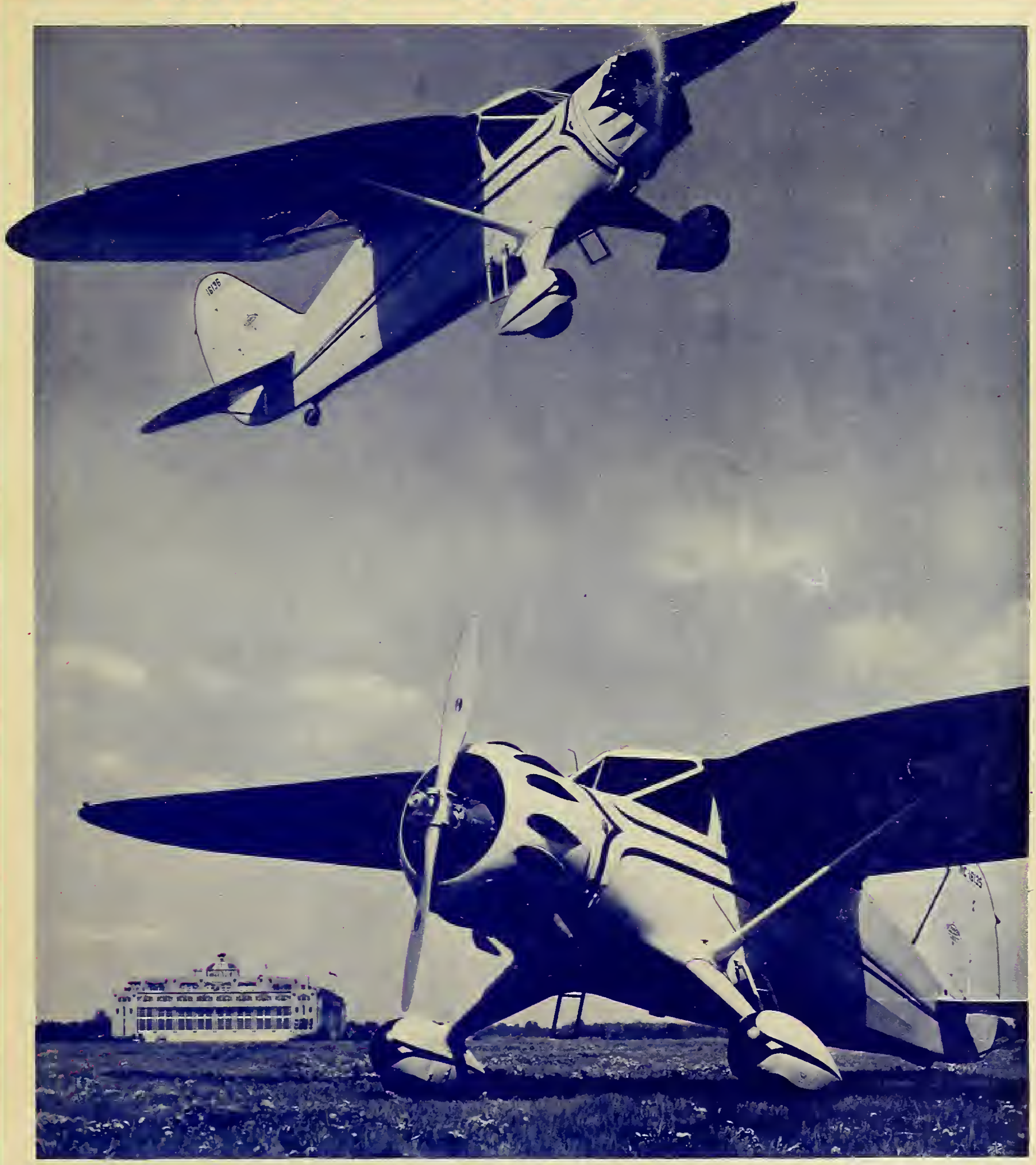

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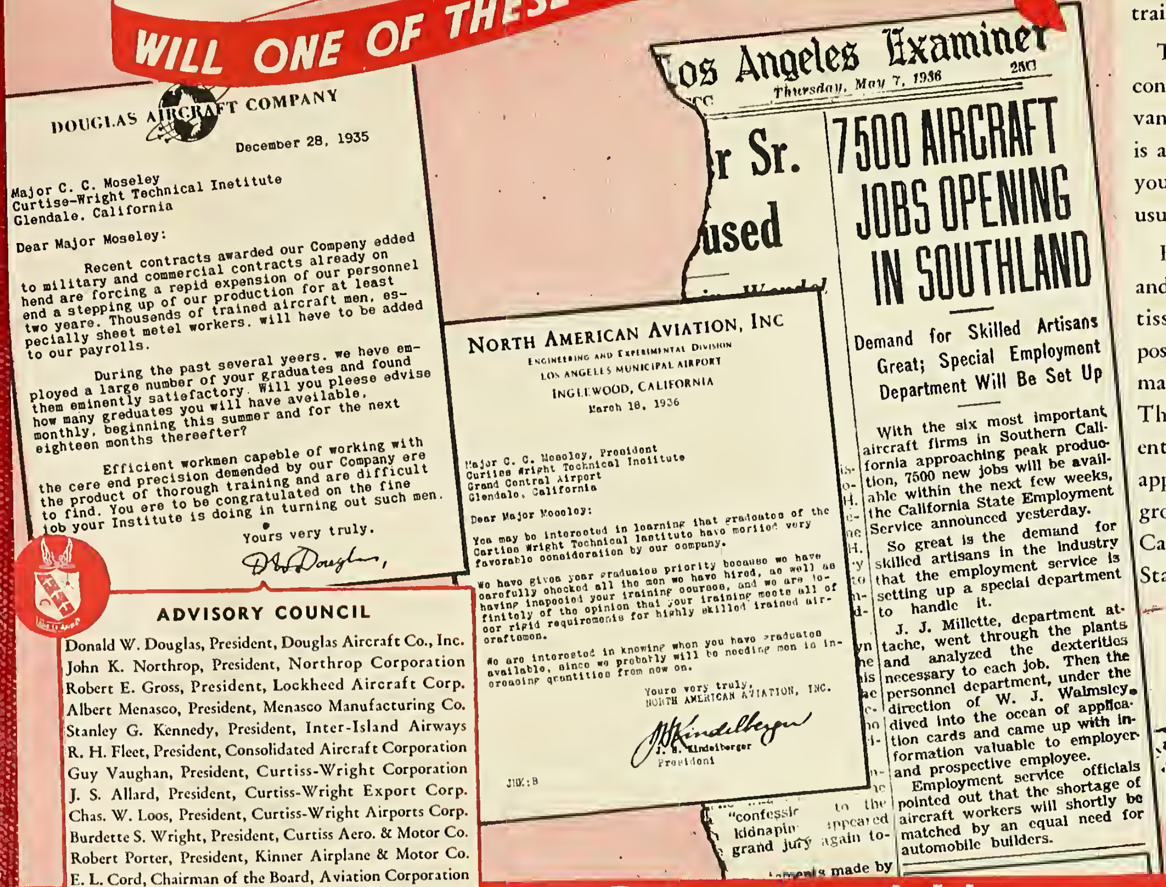

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Recent contracts awarded our Company added to military and commercial contracts already on hand are forcing a rapid expansion of our personnel and a stepping up of our production for at least two years. Thousands of trained aircraft men, especially sheet metal workers, will have to be added to our payrolls.

During the past several years, we have employed a large number of your graduates and found them eminently satisfactory. Will you please advise how many graduates you will have available, monthly, beginning this summer and for the next eighteen months thereafter?

Efficient workmen capable of working with the care and precision demanded by our Company are the product of thorough training and are difficult to find. You are to be congratulated on the fine job your Institute is doing in turning out such men.

Yours very truly,

D W Douglas

NORTH AMERICAN AVIATION, INC
ENGINEERING AND EXPERIMENTAL DIVISION
LOS ANGELES MUNICIPAL AIRPORT
INGLEWOOD, CALIFORNIA

March 18, 1936

Major C. C. Moseley, President
Curtiss Wright Technical Institute
Grand Central Airport
Glendale, California

Dear Major Moseley:

You may be interested in learning that graduates of the Curtiss Wright Technical Institute have merited very favorable consideration by our company.

We have given your graduates priority because we have carefully checked all the men we have hired, as well as having inspected your training courses, and we are definitely of the opinion that your training meets all of our rigid requirements for highly skilled trained aircraftsmen.

We are interested in knowing when you have graduates available, since we probably will be needing men in increasing quantities from now on.

Yours very truly,
NORTH AMERICAN AVIATION, INC.

J H Kindelberger
J. H. Kindelberger
President

JHK:B

Los Angeles Examiner

Thursday, May 7, 1936

r Sr.

used

"confessi… to the
kidnapin… appeared
grand jury again to-
…ments made by

7500 AIRCRAFT JOBS OPENING IN SOUTHLAND

Demand for Skilled Artisans Great; Special Employment Department Will Be Set Up

With the six most important aircraft firms in Southern California approaching peak production, 7500 new jobs will be available within the next few weeks, the California State Employment Service announced yesterday.

So great is the demand for skilled artisans in the industry that the employment service is setting up a special department to handle it.

J. J. Millette, department attache, went through the plants and analyzed the dexterities necessary to each job. Then the personnel department, under the direction of W. J. Walmsley, dived into the ocean of application cards and came up with information valuable to employer and prospective employee.

Employment service officials pointed out that the shortage of aircraft workers will shortly be matched by an equal need for automobile builders.

ADVISORY COUNCIL

Donald W. Douglas, President, Douglas Aircraft Co., Inc.
John K. Northrop, President, Northrop Corporation
Robert E. Gross, President, Lockheed Aircraft Corp.
Albert Menasco, President, Menasco Manufacturing Co.
Stanley G. Kennedy, President, Inter-Island Airways
R. H. Fleet, President, Consolidated Aircraft Corporation
Guy Vaughan, President, Curtiss-Wright Corporation
J. S. Allard, President, Curtiss-Wright Export Corp.
Chas. W. Loos, President, Curtiss-Wright Airports Corp.
Burdette S. Wright, President, Curtiss Aero. & Motor Co.
Robert Porter, President, Kinner Airplane & Motor Co.
E. L. Cord, Chairman of the Board, Aviation Corporation
Gerard F. Vultee, Vice-President & Chief Engineer, Airplane Development Corporation
Thomas A. Morgan, Chairman of the Board, Curtiss-Wright Corporation
T. P. Wright, Director of Engineering, Curtiss-Wright Corporation
Walter L. Seiler, General Manager, Wilmington-Catalina Airlines

HERE IS YOUR ANSWER

Never before has the Aviation Industry faced such a serious shortage of trained men.

This is *your* opportunity. If you are considering an aviation career take advantage now of specialized training that is approved by the men who will use your services, and capitalize on this unusual opportunity.

Both the Aeronautical Engineering, and Master Mechanics' Courses at Curtiss-Wright train you in the shortest possible time for positions most in demand and which pay the best salaries. These courses are recognized by the entire industry and Curtiss-Wright is approved as a Department of Commerce ground school and repair station, by the California State Board of Education for State teachers' training, and is affiliated with the State Junior Colleges granting college credits—a recognition unsurpassed by any other aviation school.

Enrollment at Curtiss-Wright is limited in order to maintain this high standard for which the school is famous. Students benefit tremendously because of these facts. Positions are frequently arranged for students before they leave school and for many months Curtiss-Wright has been unable to supply the demands for its graduates.

This is your big opportunity, but time is precious. This situation may not come again and someone else may get the good position you could have had. Act now and send the coupon today for full information. * *Audaces fortuna juvat timidosque repellit.*

*"Fortune favors the bold and repels the timid." Mail the coupon.

CURTISS-WRIGHT TECHNICAL INSTITUTE
GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIF.

Please send information on Courses checked:

☐ Aero-Engineering
☐ Master Mechanics
☐ Home Study

Date I plan to enroll____________________
Address____________________
Name____________________

CURTISS-WRIGHT TECHNICAL INSTITUTE

MAJOR C. C. MOSELEY, President
GRAND CENTRAL AIR TERMINAL · GLENDALE · LOS ANGELES · CALIFORNIA

One of

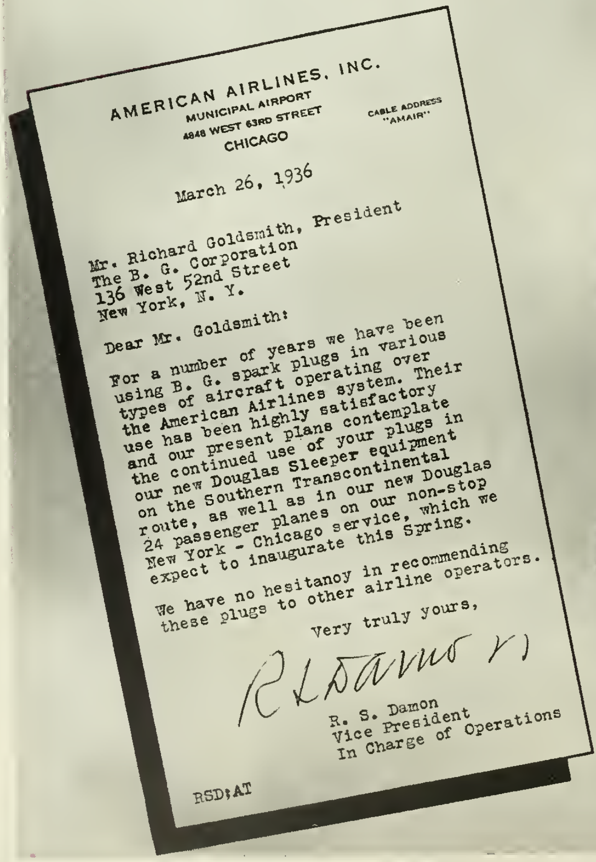
"THE AMERICAN FLAGSHIPS"

Douglas — Wright Powered

—of—

AMERICAN AIRLINES

Safety, Speed, Comfort, Luxury
By Day and By Night



AMERICAN AIRLINES, INC.
MUNICIPAL AIRPORT
4848 WEST 63RD STREET
CHICAGO

CABLE ADDRESS
"AMAIR"

March 26, 1936

Mr. Richard Goldsmith, President
The B. G. Corporation
136 West 52nd Street
New York, N. Y.

Dear Mr. Goldsmith:

For a number of years we have been using B. G. spark plugs in various types of aircraft operating over the American Airlines system. Their use has been highly satisfactory and our present plans contemplate the continued use of your plugs in our new Douglas Sleeper equipment on the Southern Transcontinental route, as well as in our new Douglas 24 passenger planes on our non-stop New York - Chicago service, which we expect to inaugurate this Spring.

We have no hesitancy in recommending these plugs to other airline operators.

Very truly yours,

R. S. Damon
Vice President
In Charge of Operations

RSD:AT

THE BG CORPORATION

NEW YORK

All Aviation hails **United Airlines**

In completing one hundred million miles of scheduled flight within a decade, United Airlines wins high distinction. On its swift transports—as on the ships of major airlines the world over—Sensitive Altimeters and other Kollsman Instruments are standard equipment.

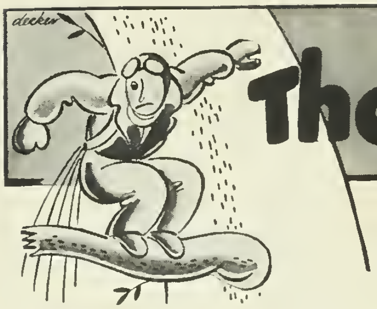
KOLLSMAN

PRECISION AIRCRAFT INSTRUMENTS

ACCELEROMETERS • AIR SPEED INDICATORS • ALTIMETERS • SENSITIVE ALTIMETERS • CLOCKS • COMPASSES • ARMY AND NAVY STANDARD COMPASSES • APERIODIC COMPASSES • ENGINE GAGE UNITS • FUEL QUANTITY GAGES • OIL AND FUEL PRESSURE GAGES • ICE WARNING INDICATORS • LEVEL FLIGHT INDICATORS • MANIFOLD PRESSURE GAGES • PITOT STATIC TUBES, FOR MONOPLANES AND BIPLANES, WITH OR WITHOUT ELECTRIC HEATER • SUCTION GAGES • TACHOMETERS, CENTRIFUGAL AND ELECTRIC • THERMOMETERS, OIL, WATER, MANIFOLD AND CARBURETOR • VERTICAL SPEED INDICATORS • SPEED AND DRIFT INDICATORS

KOLLSMAN INSTRUMENT COMPANY, 5 JUNIUS STREET, BROOKLYN, NEW YORK

WESTERN BRANCH, 1224 Airway, Glendale, California **EUROPEAN DIRECTOR:** Com. M. Calderara, 47, Av. de Brimont, Chatou (S. & O.) France



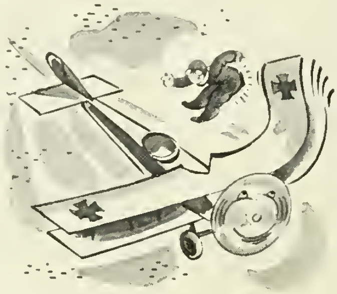
The Birdmen's Perch

Let's have 'em, fellows. This is your page . . . so speak right out in meeting. Send in every yarn, bit of gossip and personal experience that comes your way. We're getting great stuff all the time . . . but can always use more.

MAJOR AL WILLIAMS, *Manager, Aviation Department,*
Gulf Aviation Products, Gulf Building, Pittsburgh, Pa.

IN AND OUTER

During a dogfight in the World War a German, flying a Junker armored plane, hit an airpocket and was tossed out on the wing. Just as the Heinie was figuring that he'd try to render a last service to his country by landing on a French general, the plane hit another pocket and tossed him neatly back into the cockpit.



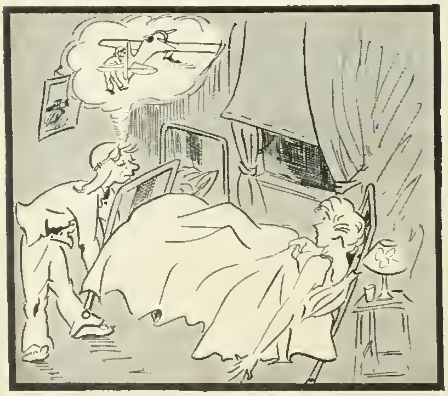
He wasn't a member of Von Richthofen's "Flying Circus," either.

—R. O. G.

DID YOU KNOW?

That Benny Howard and Harold Neuman in winning the two most important events at the National Air Races, the Bendix and Thompson Trophy Races, fueled with Gulf Aviation Gas and lubricated with Gulfpride.

Pennsylvania Air Lines, one of the biggest users of Gulf Aviation Gasoline, celebrated its ninth birthday April 26th. Ticket number 103,103 was presented to Mr. Alexander Howie, of Cleveland, who used to fly the line back in the days when they threw a passenger in among the mail bags, stamped him "Special Delivery," and limited his baggage to his watch and keys.



WORKING THE NIGHT SHIFT

C. M., of Pennsylvania, sends us this one about a local flying club:

Our field is cursed with a wind that changes direction every five minutes . . . and our plane is so light we have to shift her each time the wind veers, so she won't turn over.

The night after one of the boys had spent a particularly shifty day, his wife dreamed she was seasick and awoke to find hubby, sound asleep, hauling the foot of her bed around towards the window.

She squawked and asked exactly what was going on. "'S'all right," mumbles the sleepy one. "'m just turning her tail into the wind so she won't upset!"

THIS MONTH'S WHOPPER

Gentlemen—'Tis due directly to ye're domned Gulfpride Oil that a MacNeille—o' the Hieland MacNeilles — languishes in a Yonkee hoosegow.

In parsuit o' my duties as chief mechanic o' the airpor-rt, I noticed that the flyin' laddies wad no touch any other oil but Gulfpride. Aye, they were fair close to bein' narrow-minded on the subject.

The advontages of the situation were obvious. 'Twas but the wairk of an evenin' to filter through mosquito nettin' twa barrels o' Gulfpride . . . whuch the lads ha' drained fra' their crankcases after monny a mile o' sairvice. And 'twas but a wee job selling them their ain oil back again at a handsome profit to masel'.

A bonny plan indeed, and should ha' yielded me a deal o' pence . . . for yon Gulfpride ran as gude as before. In foct, it ran sae gude it tempted me to tur-rn an extra penny!

At fir-rst, when I put a quar-rt of water in each gallon, the lads didna notice . . . for the oil ran pairfectly. But when its admirable pairformance led me to try thr-r-ee drops of Gulfpride to a quar-rt of water, ye're oil betrayed my tr-rust. It wad no be fittin' for me to tell ye what the flyin' laddies said when they found out, but may ye never see men gae daft wi' rage!

'Tis plain that Gulf is responsible for my confinement and should provide my bail. And since it is a matter of impor-rtance, can ye no hurry up a bit?

ANGUS MAC NEILLE

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF

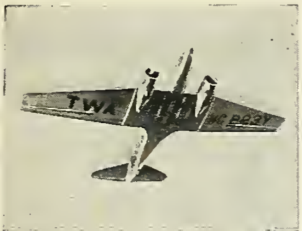
GULF AVIATION PRODUCTS

AVIATION'S LEADERS ENDORSE PARKS AIR COLLEGE...

When American Airlines, in addition to many other requests for graduates, wires Parks Air College:

American Airlines operates 6,436 miles of airline routes and flies a million miles monthly.

Fairchild Aircraft Corporation is building ten of these "Baby Clippers" for Pan American Airways.



TWA uses Douglases exclusively on its New York-Los Angeles routes by way of Chicago and St. Louis.

Pan American Airways operates 40,000 miles of airline routes in three continents and over the Pacific.

WILL SELECT SIX APPLICANTS FOR STATION PERSONNEL POSITIONS UNDER OPERATIONS STOP ADVISE YOUR RECOMMENDATIONS

and NEED TWO LINE SERVICE MECHANICS ACCORDANCE MY LETTER

and NEED TWO GOOD MEN IN ENGINE OVERHAUL WHO ARE ESPECIALLY GOOD WELDERS AND METAL WORKERS

and HAVE PARKER (not his name) REPORT FOR DUTY IMMEDIATELY TRANSPORTATION AS USUAL

and when Fairchild Aircraft Corporation answers a father's inquiry about Parks Air College by replying:

> "I think that Parks Air College of East St. Louis will offer your son as many advantages as can be found in any school in the country. I am quite familiar with the Parks setup and I know that your son will not only receive flying training but also technical and executive training which will enable him to make a connection with a manufacturing concern."

and when Transcontinental & Western Air writes:

> "It is impossible to overemphasize the importance of skill and dependability of personnel in airline operation.
>
> "Because of this fact and also because the certain growth of commercial aviation will require more well trained men than are now available, I want to tell you that I have a high appreciation of the work you are doing at Parks Air College. You can be sure that when we put on more men we will get in touch with you.
>
> "You will be interested in knowing that the many graduates of your school whom we have employed have turned out to be very satisfactory men."

and when Pan American Airways writes Parks Air College:

> "His services and personality (referring to a Parks flight graduate in its employ) are so satisfactory that he has gradually worked his way up from flight mechanic to full pilot and has recently been given the added responsibility of acting as operations manager on one section of our line. We shall very much bear in mind Parks Air College as a medium for obtaining well trained and efficient flying personnel."

and when many other leaders of aviation freely offer similar endorsements and also call for Parks graduates as rapidly as they are available you can be sure that with Parks training you will fulfill their requirements; that Parks training has their approval and that Parks training will open up for you opportunities with the more substantial companies in the industry.

Summer Term
July 6

Fall Term
Sept. 28

FREE CATALOG

Why aviation's leaders endorse Parks Air College is explained in the catalog. It describes the College's complete facilities for aviation training and outline the courses offered. Send for your copy now. It is free. The filled-in coupon will bring it to you.

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce.

Accredited by the Illinois Superintendent of Public Instruction.

PARKS AIR COLLEGE

WORLD'S LARGEST COMMERCIAL AVIATION SCHOOL

SECTION 6 AD

EAST ST. LOUIS, ILL.

Send me full information about Parks Air College, particularly concerning courses checked at the right.

Name____________________ Age________
Address____________________
City____________________ State________

CHECK HERE
for special information on the course that interests you:
☐ Executive Transport Pilots'
☐ Aeronautical Engineering
☐ Master Mechanics' Flight
☐ Executive Course

★

NEW YORK
RALEIGH
MIAMI
HAVANA
SAN JULIAN
PUERTO BARRIOS
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SAN SALVADOR
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SANTIAGO
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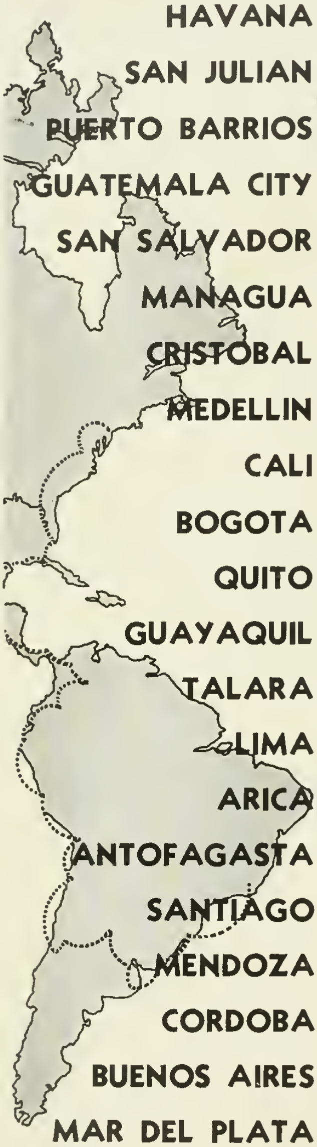
CORDOBA
BUENOS AIRES
MAR DEL PLATA
MONTEVIDEO
PORTO ALEGRE
RIO DE JANEIRO

★



12,000 MILES
over
CENTRAL AND SOUTH AMERICA
an easy flight for
BEECHCRAFT

On a recent tour of Central and South America in the interests of Beechcraft, Jacobs engines, Fairchild cameras, Kreusi radio compasses and Merrimac finishes—in company with Burnham Litchfield of Fairchild—O. J. Whitney covered 12,000 miles of difficult country and put in three months of intensive sales work. Any other means of travel would have required at least one year and several times the expense.

During this tour the 225 h.p. Jacobs Beechcraft was in the air for a total of 160 unfaltering hours, and made approximately 600 take-offs and landings—frequently from poorly developed fields and at altitudes as high as 10,000 feet. The Beechcraft averaged 160 m.p.h. with 2 passengers and baggage, miscellaneous equipment for sales demonstrations, and fuel for 1000-mile range.

Considerable flying was done at 14,000 feet (and as high as 17,000) over mountain peaks and jungles respected by every pilot who knows South America. But the Beechcraft performed without mishap, in a truly efficient fashion. In fact, it was sold in Buenos Aires and its new owner writes: "I find the plane in excellent condition. I am very happy with it and believe it to be the best plane in the Argentine."

As Central and South American distributor for Beechcraft, as well as for the northeastern United States—and as operator of the O. J. Whitney Flying Service, the largest charter organization in the east—Mr. Whitney is particularly qualified to advise you on the suitability of Beechcraft for private, commercial and military purposes. Let him demonstrate the new 285 h.p. Jacobs Beechcraft—it cruises at 177 m.p.h., using only 14 gallons of gasoline an hour, giving 10 miles plus per gallon.

Phone: NEwtown 9-0300 for demonstration

BEECH-AIR SALES COMPANY, INC.
511 FIFTH AVE. *(Northeastern Distributor for Beechcraft)* **NEW YORK, N. Y.**
Affiliated with
O. J. WHITNEY, INC.
NORTH BEACH AIRPORT *(Flying Service)* **JACKSON HEIGHTS, N. Y.**

★ **Business Men's and Sportsmen's Charter Service** ★

Here, at your disposal—day or night—is an organization with standards of Safety and Efficiency unsurpassed by any other charter group. Up-to-date Beechcrafts—on wheels and floats—as well as other types for any required purpose, are constantly ready for short or extended flights. Planes are radio equipped and have full complement of blind flying instruments. Only pilots of long and varied experience employed. An efficient ground organization, with complete service and repair facilities, maintains all equipment in well-groomed and perfect operating condition. Reservations at all hotels, travel and air ticket agencies, telegraph offices; or direct through the O. J. Whitney, Inc., Flying Service.

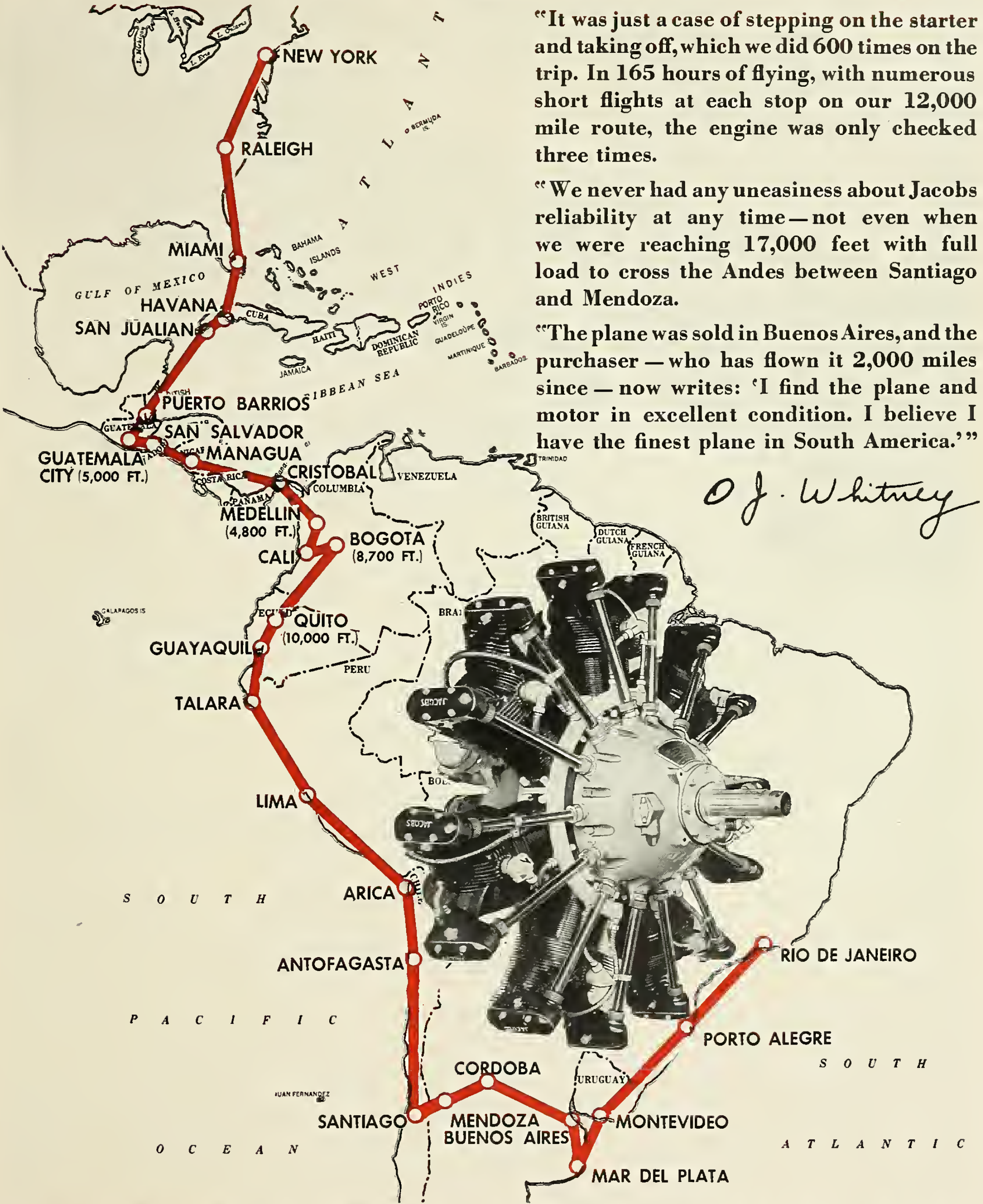
Mr. O. J. Whitney, who flew the trip shown on the map in a standard 225 H. P. Jacobs Beechcraft, writes:

"It was just a case of stepping on the starter and taking off, which we did 600 times on the trip. In 165 hours of flying, with numerous short flights at each stop on our 12,000 mile route, the engine was only checked three times.

"We never had any uneasiness about Jacobs reliability at any time—not even when we were reaching 17,000 feet with full load to cross the Andes between Santiago and Mendoza.

"The plane was sold in Buenos Aires, and the purchaser—who has flown it 2,000 miles since—now writes: 'I find the plane and motor in excellent condition. I believe I have the finest plane in South America.'"

O. J. Whitney



JACOBS AIRCRAFT ENGINE CO.

POTTSTOWN, PENNSYLVANIA

Owners Write Volumes About This Amazing Airplane

We'll let you in on a secret about our advertising . . . we don't write our own ads! As a matter of fact our advertising copy should all be printed in quotation marks, because it is merely a compilation of remarks, comments, letters and telegrams from Beechcraft owners. If it were practical to classify and print all of these in a set of thick books the resulting volume of first hand evidence of *Beechcraft's amazing performance* would be almost as convincing as just one flight in a New Beechcraft . . . . may we send you detailed performance data?

The BEECH AIRCRAFT COMPANY, Wichita, Kansas

BEECHCRAFT

TYPE 1042...Self-contained Climb Indicator. No air chamber. Greater sensitivity. Less lag. Compensated for altitude and temperature. Lighter. Easier to install.

Planes of the U. S. Fleet must carry out their assignments regardless of the weather. Handling aircraft under adverse conditions puts a premium on dependable instruments as well as piloting skill.

The extra stamina that makes equipment stand up under punishment, is built into every Pioneer Instrument. Since 1919 they have added to the security of Army, Navy, Marine Corps and Commercial Flying.

PIONEER INSTRUMENTS

PIONEER INSTRUMENT COMPANY, INC. • 754 LEXINGTON AVENUE • BROOKLYN, N. Y.
A SUBSIDIARY OF THE BENDIX AVIATION CORPORATION

Dallas Aviation School and Air College

LOVE FIELD *A Government Approved School — Established 1926* DALLAS, TEXAS

IN OUR 10TH YEAR

SCHOOL FACILITIES

4 class rooms
Motor shops
Machine shop
2 wood-working shops
2 aircraft shops
5 hangars
5 dormitories
School cafe
Radio department
Instrument department
Sheet metal shop
Propeller department
Plating shop
Battery department
Sand blasting shop
Supply department
Parts department

All our operations are at LOVE FIELD

—a million dollar airport

A $250,000 School Plant

55,000 square feet of floor space for school purposes

Location—best in the nation for aviation training

● This school was organized way back in 1926 and has been a success from the start. We have graduated more than 1,100 students who have come here from all over the U. S. and many foreign countries.

● We have always stood squarely on our own feet, paid our own way and have gradually built up a school plant and organization second to none in the U. S.

● Our advertising has always been conservative. We have never claimed to have anything we did not have or made promises we did not keep.

● This school has always been operated on a "man to man" basis, and along strictly business lines. Students may enroll here with every confidence that their course will be a success and that full cooperation will be given by school instructors.

● We invite correspondence if you are interested in aviation training, either on the ground or in the air.

You Can't *BUY* More—
Why *PAY* More?

The Texas Centennial is now under way at Dallas—America's big show of 1936. Don't miss it!

OUR TEXAS CENTENNIAL CATALOG is ready and a copy will be sent upon application. It tells the whole story of this wonderful school. We will also tell you about our **Special Centennial Enrollment Offer.**

Liberal transportation allowances—part time work if desired.

SCHOOL SHIPS

An Incomparable Line-up

Tri-Motored Ford 14 Place
Bellanca Cabin 6 Place
Waco Cabin 4 Place
Stinson Cabin 4 Place
Stearman Wasp 3 Place
Stearman Whirlwind 3 Place
Fledgling 2 Place
FIVE Fleets

Latest Addition

New Low Wing Aeronca Cabin 2 Place

13 super *excellent* ships

Our School Flying Equipment Is Unequaled in All America

30 Motors, all types

COURSES WE OFFER

Master Airman
Transport Pilot
Limited Commercial Pilot
Private Pilot
Amateur Pilot
Advanced Aviation
Master Mechanics
Combined Mechanical and Flight Courses
Radio Courses
Metal and Woodworking
Aircraft Instruments

DALLAS
AVIATION SCHOOL AND AIR COLLEGE

Love Field - - - - Dallas, Texas

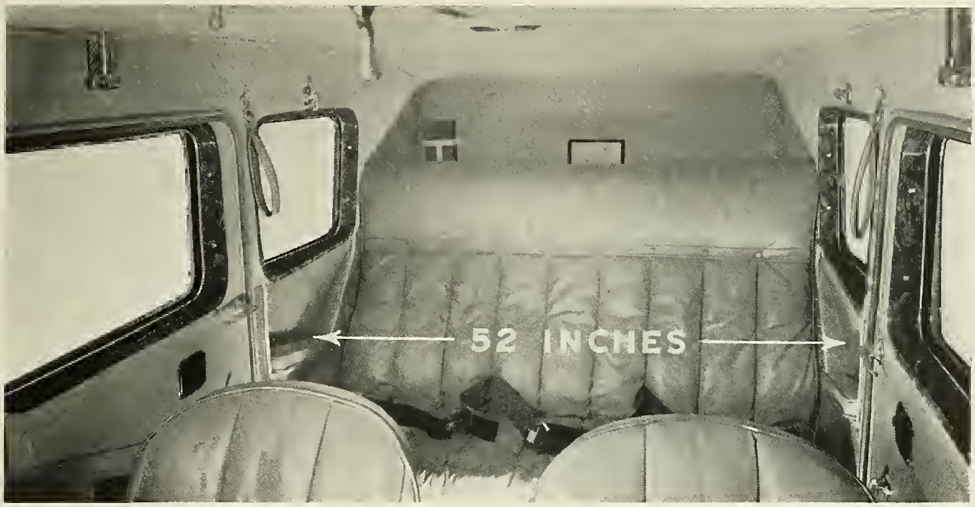
Dallas Aviation School & Air College,
Love Field, Dallas, Texas.

Send catalog and details of your special Centennial enrollment offer to:

Name

Address

★ ★ ★ ***This is a Stinson 'Reliant' Year*** ★ ★ ★



(Motor Car width at elbows across rear seat)

Not only the Most Spacious and Comfortable—but the Easiest to Fly

Five Passenger Capacity available in these models

Reliant SR 8B; 245 HP Lycoming; Controllable Propeller; Uses 73 Octane gas

Reliant SR 8C; 260 HP Lycoming; Controllable Propeller; Uses 80 Octane gas

Reliant SR 8 D & E; 285 and 320 HP Wright Motors; Controllable Propellers; Using 73 and 80 Octane gas respectively

THE SR-8 Series of the 1936 Stinson 'Reliants' offer motor car comfort for five (5) persons or luxurious spaciousness for four (4).

Important as this is, the 'Reliant' with its HIGH wings also gives you the smoothest ride and is the easiest to fly of all the higher powered airplanes.

While others are attempting the ultimate in speed regardless—Stinson concentrates on BALANCED performance, by which we mean the best COMBINATION of desirable essentials.

See and fly in this latest Stinson contribution to safe, swift, and comfortable air travel.

Read May Issue of Stinson Plane News

Stinson Aircraft Corporation

Division of Aviation Manufacturing Corp.

WAYNE MICHIGAN U. S. A.

NORTHROP

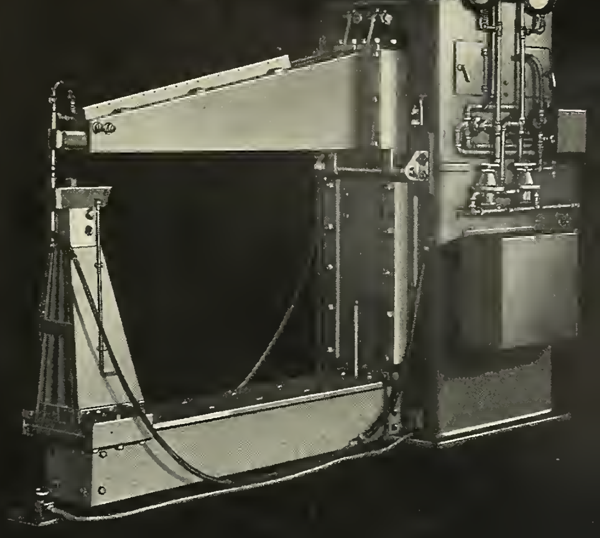
There is this obligation self-imposed on pioneers: To better—always—what has been accomplished in the past . . . Progress never ceases at Northrop, and so it is that the new Northrop long range aircraft surpass everything that Northrop has produced. The Northrop Corporation • Inglewood, California.

Federal

Leads with the Largest Spot Welder in the World for

AIRCRAFT INDUSTRY

Illustration shows one of the FEDERAL Spot Welders that makes airplanes safer.



til recently it was thought that aluminum and aluminum
oys could not be spot welded satisfactorily.

e Federal Machine & Welder Company proved it could be
ne quickly and economically. Now, many of the larger
craft industries, quick to take advantage of anything to
ke their ships safer, are using "Federal" welders.

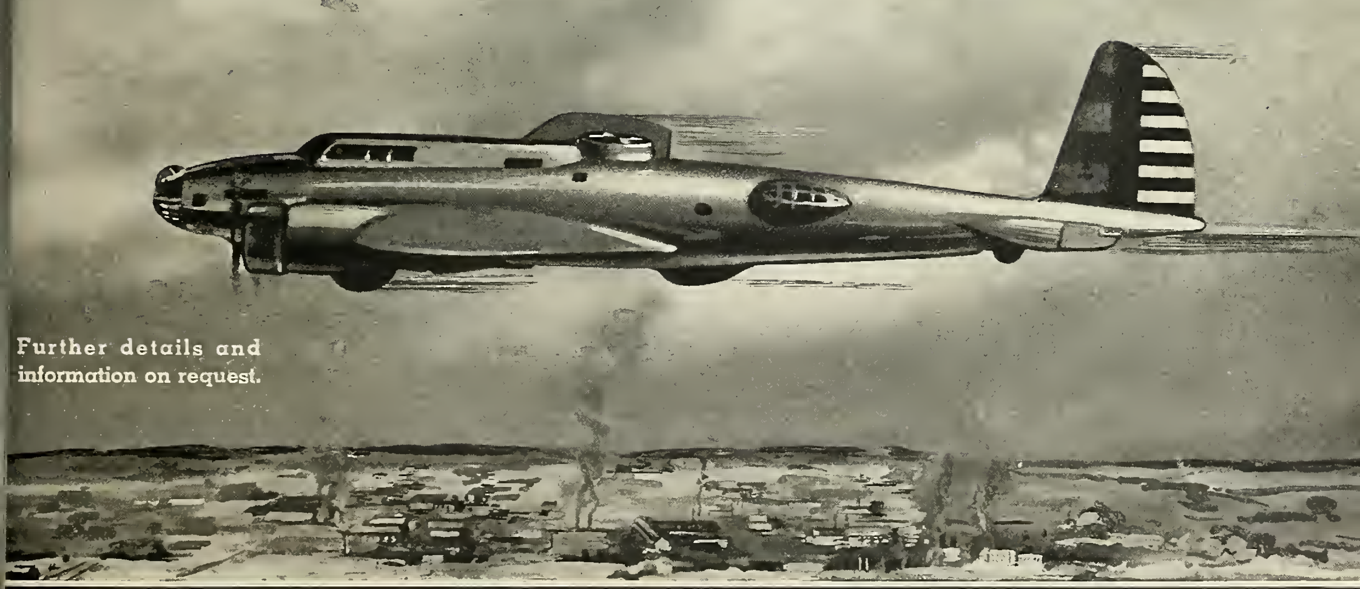
r instance, Boeing bombers, built to the most rigid govern-
ent requirements, trim as a pilot's uniform, are making use
spot welded construction.

- Frame—Fabricated Steel.
- Throat Depth—72".
- Vertical Opening—36".
- Capacity—2 pcs. 1/8" aluminum or aluminum alloy.
- Transformer Capacity—400 KVA.
- Electrodes—1" dia. water-cooled Elkaloy.
- Pressure by air, by convenient foot operated switch.
- Electric timing from 1/2 cycle up to 30 cycle by Thyratron or Ignitron Tube Control.

Federal BUTT SPOT SEAM **Welders**

Results—

- Quicker and more economical assembly.
- Reduced weight of ship.
- Trimmer appearance.
- The exposed surfaces having no rivets offer less resistance to air flow.



Further details and information on request.

he Federal Machine & Welder Company

ELECTRIC WELDERS OF ALL TYPES

Factory and Home Offices: Warren, Ohio

SALES OFFICES

Buffalo, N. Y.
2006 Rand Bldg.
Chicago, Ill.
9 S. Clinton St.
Cincinnati, Ohio
626 Broadway
Cleveland, Ohio
2036 E. 22nd St.

Detroit, Mich.
2832 E. Grand Blvd.
Los Angeles, Calif.
Smith Booth Usher Co.
2001 Santa Fe Avenue
San Francisco, Calif.
Moore Machinery Co.
550 5th St.

Philadelphia, Pa.
Bourse Bldg.
Pittsburgh, Pa.
Leonard R. Nourie
Park Bldg.
Worcester, Mass.
Taylor-Hall Welding Corp.

New York City
Room 569, 50 Church Stree
St. Louis, Mo.
Halpin Company
4116 Clayton Avenue
Tulsa, Okla.
Bramer Machine & Tool Service
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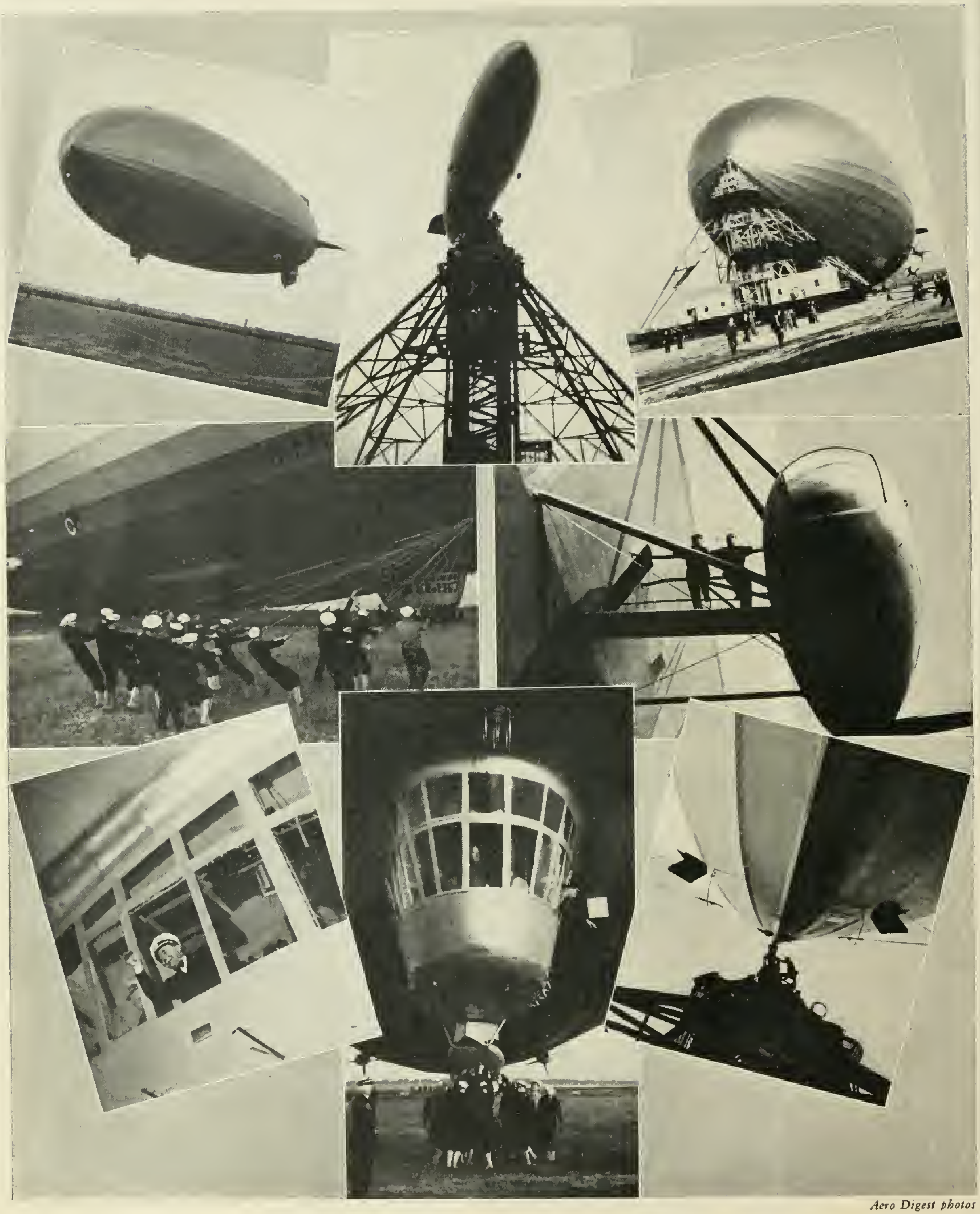


Aero Digest photos

Successful Inauguration of Regular Trans-Atlantic Commercial Airship Service

The Zeppelin "Hindenburg" arriving at the U. S. Naval Air Station, Lakehurst, N. J., May 9, upon completion of her 3900-mile flight from Friedrichshafen, Germany, with 51 passengers and more than 2,000 pounds of mail and freight

AIR
HOT AND OTHERWISE

●

FRANK A. TICHENOR

● Flying boats are soon to ply the air across the Atlantic. Of course, it might be expecting too much to think that this will be wholly an American venture. Even the Curtiss flying boat *America* built in 1914 for a trans-Atlantic flight (which was not attempted because of the war) was constructed for a British officer who had prophetic visions of American aviation's importance. First to fly the Atlantic, with our Navy-Curtiss flying boats in 1919, and having inaugurated a service across the Pacific last year, we again revert to type, rest on our laurels and watch foreign nations "pioneer" something that we should have put on a paying basis long ago.

Starting with Germany's Zeppelin, and following with British boats, the Atlantic airways are to serve our shores using foreign equipment and foreign capital. France too will be seeking a likely landing place on this side of the Atlantic for her huge Latecoere flying boats of the *Lieutenant de Vaisseau Paris* type, but the threat on her score is a bit more remote. While she is deciding whether to rebuild the ship which capsized off the coast of Pensacola or to construct an entirely new ship, we will have to contend only with German and English plans and products.

This time England is ready to put into regular scheduled service one of her new *Empire* flying boats, twenty-six of which have been built for Imperial Airways for long-range high-speed passenger, mail and express service.

British Learn Fast

Great Britain has shown on innumerable occasions that she has capable pupils who are not only eager and ready to learn, but who learn things fast. The history of the Schneider Trophy Races is an illuminating example of what may happen to us if we are to follow our usual policy. Having been the first to abandon the flying boat for a seaplane type we gave other international contestants a swell licking for a couple of successive years and then decided to bask in the glory of our victories. Not so with our brothers across the seas. They proceeded to copy the twin-float seaplane, the skin radiator and a couple of other American ideas, threw in for good measure a new government engine subsidy, developed the most powerful engine for that period and licked the pants off us—well, not off our engineers and industry, but off our government "wise" men. We shudder lest history be repeated in this instance.

When Pan American Airways, with foresight and spunk, sponsored the development of the large flying boat, it was a bold and commendable move. Our designers have long had tentative layouts of even larger craft and spent many days of wistful sighing over their "brain storms." But there was little outlet for their talents since our military services are reluctant to embrace a new idea unless somebody else proves and pays for it. Pan American paid and proved and the outcome of this program saw Sikorsky's S40 and S42 and the 50,000 lb. Martin boat. The performance of these planes is our proud history today. The British were first to grasp the fruits of American ingenuity and lost no time in procuring Sikorsky's license for their design. The result of their mimicking our products is the *Empire* flying boat which is larger than the Martin Clipper ships and similar to Sikorsky in design. The new British boats lost their Oxford accent, built-in headwinds, and hostelry appearance, and assumed the streamline of American simplicity.

Pan American and other units of our commercial air transport system can hardly be expected to continue their truly pioneering enterprise unless the government steps in and shows some interest in this far-reaching development.

Our Navy should stop quibbling and order a new really large-sized long-range boat, aiding our air defense program and enabling our industry to accomplish things which they are ready and willing to accomplish. It will be found that a number of our aircraft factories have given their own effort and study to this problem and the only thing lacking is a customer in a position to foot the bill. In our government services, the Navy, being the logical arm in great need of this type of boat, should encourage the development of something which will fulfill the demands of both our Naval strategists and our air merchant marine. The fine records as put up by the Navy's largest types, like the newest Consolidated flying boat, are an indication of what might be expected from still larger types.

Or is our Navy disposed to be helpful only to the needs of a German-operated Zeppelin service? Although some claim that we owe what we know about building and operating Zeppelins to Germany, there are just as many who feel that Germany has profited by American-paid research and by the costly lessons of our late and lamented *Akron* and *Macon*.

In France, the Air Ministry is spending 135,000,000 francs (which is a lot of money, even in United States dollars) to build a number of large thirty-seven ton flying boats. They have had a regular service over the South Atlantic and it is logical to anticipate their bid for a North Atlantic air line; theirs, however, is a more difficult problem since they will have to face the impending competition of other airlines.

Great Britain, on the other hand, has an ace in the hole that cannot be very well overlooked by us. With Bermuda as their possible stop and a comparatively easy flight from there to Canada, the *Empire* flying boats can thumb their noses at us as they pass our shores to alight in Dominion waters. We have taught them how to build high performing profitable aircraft, nature has provided them with a hospitable emergency landing shore line along our extensive coast. Are we to wait until they bid for our mail and be forced to pay them while our designers and operators scamper around trying to find a few of those hard-to-earn-at-home dollars?

German Technique

What about Germany? They showed their hand in the Zeppelin service, but it is also entirely plausible that they may also wish to exploit the findings of the many successful test flights made by Von Grunau over the Arctic route. It is the custom in Germany to readily allow government money to be spent for purposes of aeronautic progress and it must be expected that Rohrbach, Dornier, Heinkel and Junkers will not sit idly by watching while others participate in ventures they know to be feasible.

With the importance of continuance of our successful entry into trans-oceanic service with American-made equipment, we cannot rest now with so many rivals eager to profit by our experience and lessons. We expect our governmental services to lighten the load of individual companies by judicious orders to enable further achievement of American ingenuity and enterprise. This interest is justifiable because it not only would allow the American public to avail itself of American type service—swift, efficient, and safe—but would also have the further advantage of providing equipment which the geography of our country and our national safety demands.

U. S. Weather Bureau photo

Lightning striking several places at once

WEATHER HAZARDS

Fourth of a series of articles on the subject of Flying Weather

●

WILLIAM H. WENSTROM

Captain, U.S.A., Meteorological Officer for Bolling Field, D. C., and Third Corps Area

U. S. Weather Bureau photo

Destructive whirling funnel of a tornado

● In addition to the frontal and cyclonic conditions described in previous articles, other weather phenomena particularly concern aviation. Common thunderstorms and occasional small gyratory whirlwinds are spectacular enough to warn everyone of their presence. Less noisy but equally hazardous are fog that forms at night, and the icing conditions that often lurk in cold weather cloud and rain areas.

Thunderstorms

Thunderstorms are overgrown cumulus clouds in which condensation of moisture and consequent vertical currents have gone far enough to build large and turbulent cloud formations. The large-scale spattering of water droplets sets up heavy electrical charges, which intermittently break through the high resistance of the air in momentary discharges that are measured in millions of volts and thousands of amperes. The accompanying diagram illustrates air currents, cloud areas and rain areas in a typical thunderstorm. Heavy downdrafts exist alongside even heavier updrafts, with consequent eddies and vortices between them. The entire formation moves with the upper winds, usually in an eastward or southeastward direction, at any speed from a few miles per hour up to perhaps 40 or more. The heaviest lightning, winds and rain are usually along the front edge of the storm. Individual storms vary greatly in size and force. One may be merely a stationary pile of clouds with an occasional weak lightning flash and some moderate rain; another may be a towering cloud mountain flickering with continuous lightning and spattering down deluges of rain and large hailstones.

Photo by the author

Thunderstorms may rise more than five miles

The chances of lightning actually striking an airplane flying in a thunderstorm appear to be somewhat greater than the chances of its striking a vehicle on the ground, because many more flashes occur in and between clouds than between clouds and earth (also, high voltages are induced in metallic conductors by flashes that pass nearby without striking). In any case, the electrical hazard is probably slight. It exists, however, and anything but a large, metal-clad transport would probably be rendered uncontrollable or otherwise destroyed by a direct hit.

Turbulence in a large thunderstorm is excessive, and there is always the possibility that it may be accompanied by destructive hail. Even light hail might soon incapacitate a fabric-covered airplane, and the larger hailstones would probably damage even a metal transport. In a severe storm, vertical updrafts may reach 100 or even 200 m.p.h. As in ordinary cumulus clouds, the least turbulent flying levels are very low or very high, but in a thunderstorm both have disadvantages. A large storm extends to such heights (20,000 ft. or more) that it is almost impossible to fly over, and there may be severe icing up where the temperatures are around freezing. If the storm is moving rapidly, its lower levels are disturbed by violent and variable winds. The squall wind blows outward (with a speed that may be 60 m.p.h. or more) from the storm at the ground, and just above this a counter current may blow inward towards the storm. A large horizontal whirl of air is thus produced, somewhat similar in action to the revolving brush of a street sweeper. Such a formation, needless to say, endangers an airplane close to the ground.

As air mass thunderstorms are usually

Photo by the author

An instrument used for airplane soundings

scattered, it is easy to fly around them in the daytime. The fact that a pilot has already flown successfully through one or more thunderstorms proves very little about his ability to fly through the next one, which may be organized on a different order. At night, it is much more difficult to pick open spaces between storms, and night flights should usually be grounded in the presence of widespread thunderstorm activity. Nor should flights be cleared at any time into thunderstorms of the frontal type, which tend to form a continuous line. Along a marked cold front between polar and tropical marine air, for example, these storms may be ranged in a line squall that offers no openings to the fastest ship.

Tornadoes and Waterspouts

Occasionally atmospheric conditions favor the formation of those small but terrifically destructive storms known as tornadoes (they are also widely, but incorrectly, known as cyclones). Just as vortices and eddies form between water currents moving at different speeds, so tornadoes tend to form where two large parallel currents of air are moving rapidly in different directions (as sometimes happens along a well-defined front). Tornado conditions are usually marked by widespread and violent thunderstorms. Mamato-cumulus clouds, bulging down instead of up, have also perhaps some vague connection wth tornado areas, and do indicate disturbed conditions in the upper air.

In addition to a peculiar atmospheric set-up, the ground surface must favor tornadoes if they are to reach any intensity. Mountains or hills nearly always prevent the formation, or break them up; though smaller whirlwinds, usually harmless, are often seen on the western deserts. Open, flat country or open water is the most favorable terrain for true tornadoes, and they are most frequent on the plains of the midwest and midsouth. They can also occur, however, on the east coast and at sea. Over the water, this type of storm is called a waterspout, and behaves much like a land tornado. Along the coastline a whirlwind can pass readily from land to water and back again, alternating between the two forms.

Photo by the author

Charting pilot balloon observations

Tornadoes can always be distinguished, unless hidden behind lower clouds or dust, by their characteristic, funnel-shaped cloud. As the tornado forms, this whirling funnel grows downward from the main cloud deck; its lower end usually writhes along the ground at any speed between 10 and 50 m.p.h., spreading destruction over a narrow, sinuous path. Needless to say, airplane pilots should avoid the vicinity of a tornado; its gyratory currents are spinning at something like 500 m.p.h.

Fog

Fog, which constitutes one of the major difficulties of scheduled aviation, is variously classified. There are first the frontal types: the warm front fog mentioned in an earlier article, and cold front fogs that go with so much other bad weather that the fog itself becomes relatively inconsequential. Of more importance are the air mass fogs, which are subdivided into advection and radiation types.

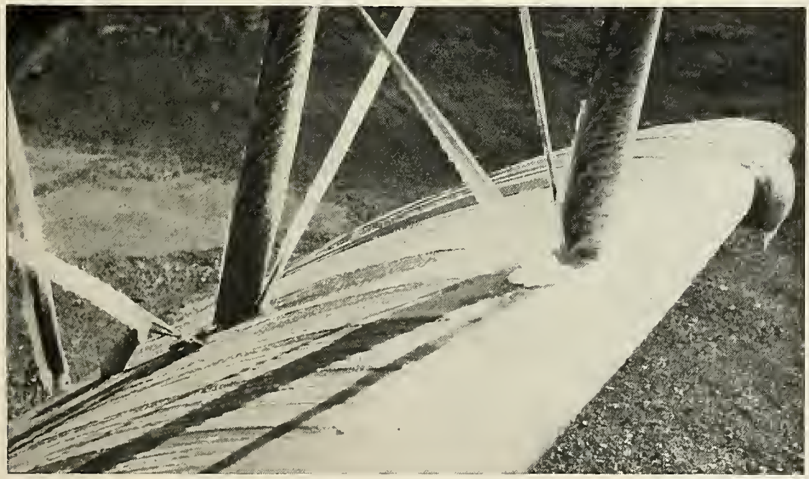


Photo by the author

Artificially produced icing, showing build up on wires and leading edges

Advection fogs are caused by (a) the flow of warm, moist air above a cold surface; or (b) the flow of cold air above a warm, moist surface. Only the former has practical importance in ordinary inland flying in the United States. It may result, for example, when a mass of warm, maritime air flows inland over a relatively cold land surface, perhaps following a warm front.

Such advection fogs, though rare, are widespread and persistent when they do occur. They usually extend northward or landward, driven by moderate southerly or onshore winds, perhaps covering a large area for days. Sometimes they thicken gradually over a wide region; sometimes they roll onward like a sea of vapor. In either case, there is likely to be ample advance warning from coastal and southern stations that are first affected. An airplane pilot can usually find clearer air by turning northward or inland.

Radiation fog, unlike the advection variety, appears over land surfaces rather suddenly where no fog existed before. It is caused by the radiative cooling of the earth at night. As heat is radiated away into space, the ground temperature falls, and with it, the temperature of the air next to the ground. In hilly terrain, this cooler air tends to drain down hill, filling depressions and valleys on calm nights. When the temperature of the cooler air reaches its dew point, water vapor begins to condense into liquid water. In absolutely still air, this water takes the form of dew. But if some circulation has mixed the air close to the ground, distributing the lowered temperatures through the lower levels, the condensed water takes the form of fog. This fog usually forms first in the lower levels and gradualy extends upward for a few hundred feet.

Radiation fog tends to form at night in the presence of three motivating factors. First, winds are light, (2-6 m.p.h.), favoring the gentle mixing of air in the lower levels (if the winds are much above 6 m.p.h., warmer air is brought down from aloft, delaying the cooling process enough to prevent fog formation). Second, mostly clear skies permit the earth-radiation to escape freely into space, favoring maximum cooling. Third, the dew point must be relatively high, so that the falling temperature will reach it during the night. An airplane pilot in flight at night can thus judge the imminence of fog from radio reports. Where there are light winds under a mostly clear sky, where the dew point is high and, most of all, where the *temperature is rapidly approaching the dewpoint,* fog is likely to form. When the temperature is more than 2° above the dew point, fog is usually at least an hour or two away.

When the two are equal or only 1° apart, however, fog may begin forming within the hour.

Instead of a surface fog, high fog may form if conditions are favorable. Perhaps the temperature decreases from the ground upward for several hundred feet, then inverts or increases. Air at the base of the inversion may have the same dewpoint as the surface air, though its temperature is considerably lower. As the whole atmosphere cools, therefore, the base of the temperature inversion reaches its dewpoint first, and the fog builds rather quickly downward from several hundred feet above the ground.

Icing

Icing, the chief difficulty in wintertime flying, may also occur at high altitudes even in summer. It takes the form of ice deposits on wings, propellers, struts and other exposed parts of an airplane. It has the effect of adding weight to the airplane and, more important, of impairing its aerodynamic efficiency.

There are three types of icing: (a) clear ice, which is the most dangerous; (b) rime, of whitish, granular structure, which forms at lower temperatures than clear ice; and (c) frost, which is relatively harmless.

Rime seldom builds out very far from the plane's surface, and can usually be cleared by de-icers unless the temperature is quite low. Clear ice, on the other hand, if permitted to accumulate, may build into blunt and air-resistive formations that, because of its strength and thickness, may not yield to de-icers. Clear ice may load a propeller, causing destructive vibration; or it may so load and distort the wings that the plane loses altitude and perhaps becomes unflyable.

Two conditions must be met before icing can appear in noticeable form. First, moisture must be present in the visible form of clouds (which are aggregations of minute water droplets), mist, rain and the like. Second, temperatures must be somewhere between 34°F. and perhaps 0°F. As liquid water droplets can exist at temperatures far below zero if they are not disturbed, there is no fixed lower temperature limit. At temperatures below 0°F., however, the percentage of water that can exist in liquid or vaporous form is so small that icing should not be at all severe. The really dangerous temperature range, where clear ice forms fast, is the few degrees just below the freezing point from 32°F. to perhaps 26°F. Icing is caused by several factors. A previously chilled airplane may strike rain or cloud droplets, freezing them. Super-cooled droplets, jostled by the wing, may freeze instantly. Certain areas of low pressure around a moving airfoil may cool the air by expansion. All these causes become minor, however, when one recollects that far more cold is required to freeze water than to cool it. This large latent heat of fusion can be removed only by evaporation, and it is probable that the cooling effect of evaporation (the airplane partially atomizing the water droplets that it strikes) is the major cause of icing.

U. S. Weather Bureau photo

Parallel banks of alto-cumulus clouds at about three miles altitude

Clear ice occurs chiefly where relatively warm, moist air is being rapidly lifted—that is, along active fronts. This active lifting occurs particularly along occluding fronts (where the whole warm sector is being pinched out and lifted upward), and most of all along a front that is occluding on the windward side of a mountain barrier. Under such extreme conditions, clear ice can form at the rate of about one inch per minute.

Rime is encountered chiefly in cold air masses, where the droplets are smaller and farther apart than they are in the warm air masses that produce clear ice. As the clouds in these cold masses are usually not as high or as dense as those in warmer masses, it is often possible to climb above the rime zone. In warmer air mass clouds, however, rime may appear in the upper levels beyond the zone of clear ice.

The most general rule for avoiding icing is to avoid precipitation areas and clouds in the critical temperature ranges. Any precipitation area having ground temperatures below 40°F. may show icing at ordinary flying altitudes. If temperatures in the lower levels are high enough, and other conditions permit, it is well to stay low. Otherwise, it is usually advisable to go as high as possible, where the air is colder and the possible amount of moisture in the air is less. At all times, the temperature range just below the freezing point should be avoided. In freezing weather, active fronts should be avoided where possible, particularly near the warm sector of an occluding cyclone, and most particularly where the cyclone is occluding against a mountain barrier.

Photo by the author

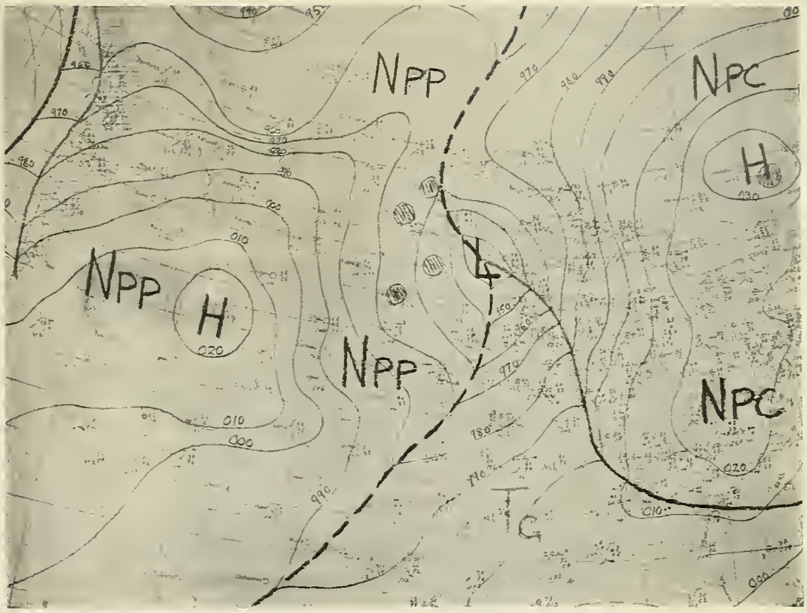
Ready to plot drift of a pilot balloon at a U. S. Army Signal Corps meteorological station

Modern Forecasting Technique

Accurate and specific forecasting requires careful, intelligent and complete analysis of the weather situation. The aim of this analysis is to identify the air masses over a given region and to evaluate their characteristics; to locate the discontinuity surfaces or fronts between unlike air masses and to evaluate the weather potentialities of these fronts; and to investigate the forces that are causing and will cause these air masses and fronts to move and to change their configurations and characteristics. Occurrences in the past few hours, such as high winds, unseasonable temperatures or heavy rainfall, must everywhere be explained in terms of physical principles. Present weather must likewise be rigorously explained. If the forecaster cannot explain it in terms of known physical interactions, his analysis is not complete. Finally, the air masses and fronts involved must be visualized as they will appear at definite times in the next 36 hours, and the physical interactions resulting along the fronts and within the air masses must be accurately imagined. The result of these mental processes is the weather forecast.

Modern weather forecasting is largely physical. Up to the present, most weather forecasting has been largely empirical. The important difference between the two methods can best be shown by an example. Suppose that the forecaster is predicting weather for Chicago, and that on the weather map there is in the region of the Rockies a disturbance, marked by a trough of low pressure over Montana and Wyoming, by southerly winds and higher temperatures west of the trough, and by widespread cloudiness and rain in the Dakotas, Nebraska and Iowa.

The empirical forecaster reasons somewhat as follows, "There is a trough-shaped low now over Montana, with a large high over the Pacific Coast. At this season the average eastward drift of lows in the belt of prevailing westerlies is about 25 m.p.h.; therefore this low should move eastward at something like this speed. If this low follows the average tracks of lows across the United States, it should move towards Chicago. Rain, accompanied by warmer weather, usually occurs to the east and southeast of a low of this type. Therefore the vicinity of Chicago should experience increasing cloudiness, with rain beginning tonight, and the temperature should rise. Further, a high of this type is usually characterized in the fall by clear, cool weather. Therefore it will clear when the high arrives here on the heels of the low, and it will also turn colder."



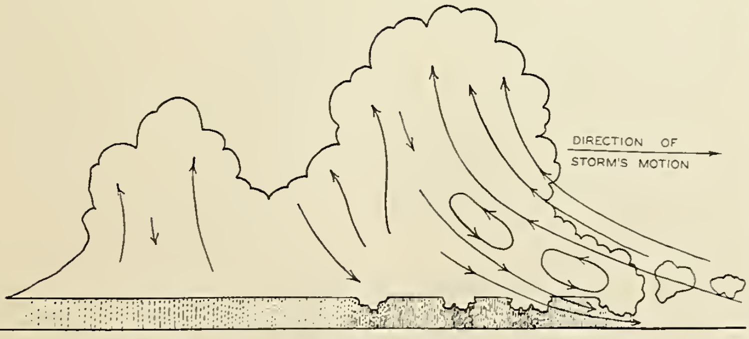
Portion of a weather map of North America

Physical Weather Forecasting

The physical forecaster reasons somewhat as follows, "A cold air mass is coming in from the Pacific. The front of this air mass is in the form of a wedge of cold air moving eastward at about 25 m.p.h., the front now extending N-S through Canada, Montana, Wyoming, Colorado, and New Mexico. East of the advancing cold wedge is somewhat warmer air that came from Canada several days ago. The temperature and moisture contrasts between the cold Pacific air and the cool Canadian air which it is displacing are not very great, so that no heavy weather is to be expected from this combination. However, in the great southerly currents ahead of the advancing cold Pacific wedge, a mass of very warm, moist air is moving northward from the Gulf of Mexico, and now covers most of the southern middle west as far north as Kansas and Missouri. This warm Gulf air is now rushing up a retreating wedge of cool Canadian air in the Nebraska-Iowa region, cooling by expansion as it climbs the inclined plane of cool air, and condensing its plentiful moisture (acquired over the steaming Gulf) in the form of heavy clouds and rain. The retreating wedge of cool air, sprinkled with steady rain from the over-running warm Gulf air above, is moving northeastward, and will bring gradually lowering stratus clouds with increasing steady rain to Chicago tonight and early tomorrow. Later tomorrow, when the cool wedge has receded eastward and Gulf air has reached Chicago even at the surface, we shall have almost Gulf weather, sunny, warm and humid, with growing cumulus clouds, and scattered showers and thunderstorms in the afternoon. Tomorrow night, when the cold Pacific air wedge rushes in from the west, we may have violent squalls and thunderstorms as the warm Gulf air is forced rapidly upward and the winds swing abruptly from south to northwest. In the new air mass it will be colder."

The actual situation at 8:00 on the forecaster's "tomorrow" is shown on the weather map reproduced with this article. Rain from the over-running Gulf air sprinkles Chicago and the country to the north for hundreds of miles.

The physical weather forecaster thus tries to make a complete analysis of what is happening in terms of air masses over certain regions, the characteristics and weather potentialities of these air masses, the fronts between unlike air masses and their weather possibilities, and the dynamic factors, such as general atmospheric circulation and the depth and momentum of large air masses, that will cause the fronts to move and to change their configuration. His constant endeavor is to understand physical principles, rather than to memorize empirical rules. His method is less cursory and more laborious than the old procedure of glancing at a simple isobaric map and guessing at the probable motion of a low. But it produces forecasts that are far more specific and considerably more accurate.



Air currents, cloud areas and rain areas in a typical thunderstorm

"I haven't any idea, sir"

VIDAL STATISTICS

●

CY CALDWELL

● The Hearings of the Subcommittee of the Committee on Commerce, of which Senator Royal S. Copeland is Chairman, were held in the Caucus Room of the Senate Office Building, a huge high-ceilinged room whose magnificence dwarfs the human animalculae who cluster around the conference table painfully accentuating the fact that man in his insignificance falls far short of the material grandeur even of his own works.

It was cheering to enter that Caucus Room and see Senator Copeland beaming upon the assemblage, to see Colonel Hartney, the Technical Adviser, leaning over confidentially to the Senator to impart some new information and to see the Three Musketeers of the Bureau of Air Commerce, Athos Vidal, Porthos Martin, and Aramis Cone, brothers all, smiling at each other like three strange hyenas.

The Hon. J. M. Johnson, Assistant Secretary of Commerce, a stern, military looking gentleman with rugged features and jutting jaw, denoting strength of character when dealing with Republicans, took the witness chair and said a few kind words about the many perfections of the Bureau of Air Commerce. Then he admitted that the Department is improperly organized. The honorable gentleman mentioned a questionnaire the Bureau had sent out to all pilots, and remarked, "The preponderance of opinion is too great for one minute to think that the airline pilots do not think we are better and that we are doing a satisfactory job under the circumstances in which we find ourselves." He failed to mention that only one in seven pilots had replied at all, and that many of those were afraid to criticize the bungling Bureau for fear of reprisals when it came time to have their licenses renewed.

He then launched into a dissertation on the Mount case, in which one Jay Mount was fired from the Bureau for protesting at conditions of non-maintenance of air navigation aids, according to Mr. Mount and most observers; but fired for quite other reasons, according to Mr. Johnson. To quote Mr. Johnson from the record: "He was discharged on my recommendation, because he said he did not know his status in the Department of Commerce at all, when I had before me his acceptance of an appointment on the first of July, and he was talking to me on the 5th of July in the presence of Mr. Vidal." That seems a peculiar reason for firing a man, for to any disinterested observer Mr. Mount's status was somewhat ambiguous. He had been discharged at one time, he had been recommended to be retained, and had been demoted to a job with less salary. Is it any wonder "he said he did not know his status in the Department of Commerce?" Yet Mr. Johnson fired him for not being clear about that! This action gives you a vivid self-portrait of Mr. Johnson.

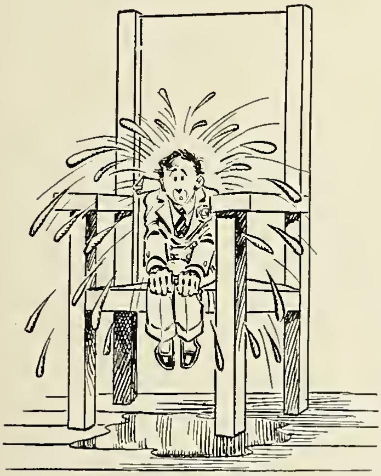
Mister Mulligan, Attorney for the Solicitor's office of the Department of Commerce, now took the stand. He comes of old fighting Irish stock, slightly softened by residence in the Bronx.

In gentle, mellifluous tones Mister Mulligan began to explain things to the Committee, and the more he explained the less anyone understood. He mentioned the weather, the radio beam, the passengers on the plane, the yokels who lived near the scene of the accident; he read testimony, messages, excerpts from logs, records of telephone conversations, and all so gently that listeners began to nod. He turned 1,200 foot ceilings into 450 foot ceilings; he changed the wind from east to west, and juggled with dew points and temperatures; he toyed with the geography of Missouri and leaped from Albuquerque to Kansas City with ease. Occasionally the Chairman, seeking to follow him, would venture a question. Mister Mulligan would answer it gently and go coursing off across the plains of legal and aeronautical technicalities with all the fleetness of Benny Howard's similarly-named racer.

For a time Senators Copeland and White endeavored to keep pace with Mister Mulligan, asking him many questions, which he answered or parried with equal ease. Soon, tiring those earnest seekers after knowledge, Mister Mulligan was solo again, reading page after page of testimony in his gentle soporific voice. Flies droned in and out of the room; Mister Mulligan droned on and ever on, quoting question and answer, question and answer, taken from his voluminous report. Once Senator White interrupted, once or twice Senator Copeland, emerging from a stupor, said something. Mister Mulligan didn't mind; patiently he replied, as patiently he resumed the even tenor of his way, weaving his verbal fabric, knotting all the various strands of evidence, lengthening here, snipping there, but indubitably fashioning his cloth into what looked surprisingly like a shroud in which to bury the testimony of Messrs. Frye and Mount. Senator Copeland remarked pathetically, "Mister Mulligan has intimated that the committee has a hard job to reach a conclusion. I am convinced that we all have . . ."

"I have nothing to do with that!"

Somewhat revived by a night's sleep, Senator Copeland next day again tackled the cause of justice, taking on Mr. Eugene L. Vidal, Director of Air Commerce, who, being informed by rumor that the committee might want to hang him, obligingly brought his own rope and, by the time he had completed his testimony, had succeeded in hanging himself. He started off reading a prepared statement, and for a time Senator Copeland, watchful and wary after the Mulligan massacre of the day before, allowed Vidal to proceed. But soon the Senator interposed a question, and then another, and another. Mr. Vidal had difficulty with each and every one of them. This emboldened the Senator. Here, evidently, was no Mister Mulligan—no crafty Irishman whose brain had been so active that it had chased all the hair from the top of his head. Here, instead, was a simple juvenile taking faltering steps on the stage of life, speaking his lines timidly, stumbling, stammering, growing red of face and jerky of movement. "But you do not know what became of the $1,500,000 in 1934?" queried the Senator, referring to a discrepancy of that amount between the total appropriation for the Bureau and the amount which the Bureau had received. "No, sir," admitted Vidal; "I haven't any idea, sir." The Senator stared at him in amazement. "Did you inquire from the auditors about it?" "Why, no, sir," replied Vidal. "That is a matter for the Department of Commerce itself. I have nothing to do with that." His department had been robbed of a million and a half dollars, and he didn't even inquire why his department had been short-changed!


"No sir; no sir!"

"The practical fact," commented Senator Copeland, "is that by a shifting of appropriations within the Department, the aviation was robbed of $1,500,000 that it might have had if the purpose of Congress had been carried out. Now I am saying that. You do not have to say that, Mr. Vidal. This chart confirms the suspicion that has been held for a long time, that the aviation has not had the benefits of all the money which we thought we were appropriating to make aviation." This statement of Senator Copeland's is, I believe, the most conclusive argument ever advanced for putting all commercial aviation under an honest and non-political body.

From that moment poor Vidal's prepared statement—probably prepared by some intelligent hack in the Bureau—went into the discard. Vidal would read from it briefly, but along would come a question from the Senator, and as the answer wasn't on the statement, Vidal was continually floundering. Asked what he would do if he got no appropriation to provide greater facilities for safety, Vidal said that they were assured of more for next year than they got this year. "But it will not modernize the system, of course," he added. "It won't prevent the funerals that are taking place?" inquired Senator Copeland. "No, sir; no, sir," replied Vidal. "Then because of a niggardly attitude on the part of Congress people are being killed, or will be?" queried the Senator. "I cannot very well say—" Mr. Vidal hesitated. The Senator interrupted sharply, "Well, I will say so." Vidal concluded—"—niggardly, no, sir." But the Senator repeated "I will say so! And if there is anybody here that will dispute that I wish he would say so now. I want this record to show conclusively, as it is the truth, that the United States Government is not providing money enough in the ground facilities to keep up with the progress of aviation in the air. Do you think that is true?" Vidal said at once, "Very much so, yes, sir." "All right," said the Senator, and Vidal added, "I have felt that for at least a year and a half."

So here we have a clear admission by the Director of Air Commerce that his Bureau did not possess the proper navigational aids, that aviation had been robbed of a million and a half dollars, that under the present system crashes could not be prevented. Yet he said nothing about these conditions until Senator Copeland was man enough to say them for him. If such weakness and such political cowardice has ever before been demonstrated in American aviation, it has escaped my notice. Yet this is the political appointee who has been (and still is) clamoring for a 'safe' $700 airplane, and damning all of our present airplanes as 'unsafe.' Mr. Vidal has demonstrated the very essence of bureaucratic ineptitude and pusillanimous poltroonery. The President once stated that if any of his experiments did not work that he would admit it. The Vidal experiment has not worked.

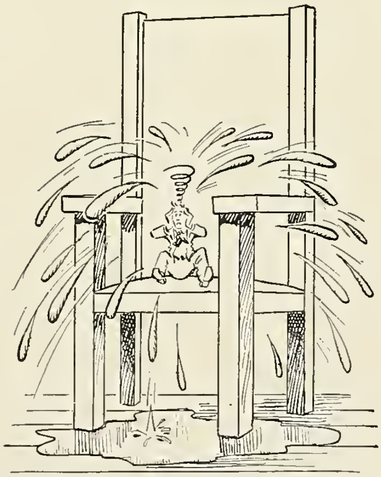
Mr. Vidal then floundered off into an involved statement regarding the use of radio aids, remarking at one point that, "the Federal aids are not necessarily safeguards to air travel. They are simply aids to increase the operating performance or efficiency of the airlines and other users." Senator Copeland looked at him dubiously. "Then do you not think probably we better save these millions and not waste our money on these aids, if they are not essential?" he queried. Vidal said he didn't agree that the aids had caused the accidents. The Chairman remarked, logically, "If they are not essential to safety and if they have not contributed to safety, why should we spend our money on them?" "In order that the airlines can complete more schedules safely," persisted Vidal. The Senator looked at him, in fact studied him as though he had been some peculiar psychopathic patient, presented to him for professional analysis. "You know," remarked Doctor Copeland kindly, "frankness compels me to say that so far as one member of the committee is concerned, I am not impressed by what you say in the matter, with all apologies."

Again the stammering and red-faced Vidal tried to explain what he seemed to be utterly incapable of explaining. Senator Clark tried to help him; but Vidal was beyond help. He was lost, and he soon lost Senator Clark along with him. "As I understand it," said Senator Clark, obviously not understanding it at all, "the pilots on ranges which do not have aids are more efficient than those on ranges of lines which do?" Mr. Vidal gazed at him helplessly. "Are more what?" he almost whispered. "More efficient or more careful on those lines where they do not have aids than on the lines where the pilots do have aids to navigation." Mr. Vidal shook his head sadly; this was evidently too much for him. He stared at Senator Clark, and Senator Clark gazed back at him. But they were like two foreigners, the one speaking Chinese, the other Yiddish.

"You are leaving me very much confused as to what is your attitude toward the aids," said Senator Copeland, coming bravely to his comrade's relief. "Suppose you tell us again. Senator Clark can understand you, but I have not on this matter."

"I do not know whether I do or not,"

(*Continued on page* 82)


Senator Copeland: "I am not impressed by what you say . . ."

EDITORIALS

> "Commander Rosendahl said that 'the tendency has been to compare the airships of yesterday with the super planes of tomorrow.' There is no question of airships superseding airplanes or fast steamers any more than airplanes superseded motor trucks or trains. But there is in the immediate future a definite place for airships of today's design."—SIR HUBERT WILKINS

Significance of Accident Records

● A good pilot is one who recognizes the limitations of an airplane, rather than one who, with too much confidence, does a rather spectacular job of flying.

To properly maintain and fly an airplane is an art, or at least it is a highly specialized vocation, and failure to realize this fact probably contributes more to the misuse of an airplane than any other factor. If the part a pilot plays were stripped of its last remnant of glamor and bravado, we should still have a profession that requires an extensive and broad training, and if established as such a profession would command a different brand of public attention than we know at present. The airplane is just beginning to be the delightful instrument of transportation that we are going to make out of it, and the airlines are fast learning how to do a good job—but the miscellaneous flyers are not.

Department of Commerce figures to the effect that accidents in miscellaneous flying in 1935 were less than in any other previous period, are somewhat encouraging, but the record is far from good. It appears that we have not begun to grasp the significance of the rather mediocre accident record in miscellaneous flying, and when one considers the high state of development that our present aircraft have reached, we are struck with the fact that pilots are probably not doing justice to the product of modern airplane factories.

A superficial analysis of accident records will show where the main causes lie, and the opportunities for improving this record are almost inspiring. Figures on accidents caused by violations of Department regulations, unnecessary acrobatics, carelessness and poor judgment, and the use of unlicensed craft stand out like a sore thumb. One-third of the accidents in miscellaneous flying are caused by careless flight instruction. Nearly one-half in pleasure flying and miscellaneous commercial operations are due to pilot errors and ten percent to bad weather. The best that can be said for miscellaneous operations is that this branch of flying is only about one-tenth as safe as scheduled airline operations, and from some angles of study, it appears that the ratio is 30:1.

The lack of enforcement by the Department is largely to blame for the majority of accidents each year, particularly those in which student and amateur pilots have carried passengers. Over-confidence probably lies at the root of other accidents and this evil can be combated only by trying to create an attitude of more conservatism and more thoroughness. Another solution lies more along the line of cooperation and education and we are confident that a vast improvement in the accident records can be immediately realized by instituting simultaneously an education program that will reach all miscellaneous flyers and mechanics, and also ask for a more far-reaching enforcement of Department regulations.

The plan of the National Association of State Aviation Officials to foster a nation-wide campaign to bring to the attention of the self-satisfied flyer that he is not quite as good as he thinks, is a project worthy of cooperation and assistance by the industry.

Hail the New Chief!

● To the Bureau of Aeronautics of the U. S. Navy this month comes Rear Admiral Arthur B. Cook to succeed Rear Admiral Ernest J. King as chief. Admiral Cook undoubtedly will fill this all-important office in the Navy with the same capabilities and sound administrations evidenced by his illustrious predecessors.

Appointed to the Naval Academy in 1901, Admiral Cook was commended by the Navy Department for his service during the World War as Flag Lieutenant and Fleet Signal Officer on the staff of the Commander-in-Chief U. S. Fleet. He qualified as a naval aviator at Pensacola in 1928; was in command of the U. S. S. *Langley;* was appointed on the staff of the Commander, Aircraft Squadrons, Battle Fleet; and served as Assistant Chief of the Bureau before taking over command of the U. S. S. *Lexington.*

To the retiring chief, Admiral King, must go credit and praise for his work at the Bureau during his abbreviated tenure of office. Not only did he continue with foresight and tact the unfinished work of the late Admiral Moffett, but he kept the lead that the aircraft arm of the U. S. Navy held over every naval service in the world.

To Admiral Cook, we extend our congratulations and wishes for the continued success of his office.

Records of The Zeppelins

● Successful and record-breaking inauguration of trans-Atlantic service by the German dirigible *Hindenburg* once again focuses attention on Dr. Hugo Eckener, who more than anyone else, has kept lighter-than-air interest alive despite the waning public enthusiasm for this branch of aeronautics.

Dr. Eckener has never emphasized, to the public at least, the fact that he started out in business to be a journalist, a writer of editorials with a distinct leaning toward political economy, a man of phrase rather than a man of action, an observer of life rather than a doer. But his ability to get the most meaning in a sentence betrays his training and is a valuable quality in his campaign to sell lighter-than-air craft.

By its 61½-hour westward crossing and 48-hour eastbound trip, the *Hindenburg* not only provided direct tangible evidence of dirigible development during the past few years, but also demonstrated its speed superiority over even the most modern of the ocean-going steamers. Both trips were made in considerably faster time than the *Graf Zeppelin* which until now held the blue ribbon for trans-oceanic travel. While the American public views the success of the dirigible with something akin to amazement, it is interesting to sense the blase attitude of South Americans, who by this time are so accustomed to the numerous crossings of the *Graf,* that they accept the dirigible as an everyday affair.

In all the acclaim for the *Hindenburg,* we must not lose sight of Dr. Eckener for he and his associates have kept lighter-than-air alive through its most difficult years. The writer and propagandist that is Eckener, ranks on a par with the engineers and inventors who have contributed to this form of transportation. He has held on through the most disheartening period in Zeppelin history to the time when the eyes of the world, largely through his efforts, are again turned favorably toward lighter-than-air.

By the end of this summer, when the *Hindenburg* has completed her scheduled crossings of the north and south Atlantic, we will have a truer perspective of her achievements and practical evidence of the American public's acceptance or rejection of this mode of transportation.

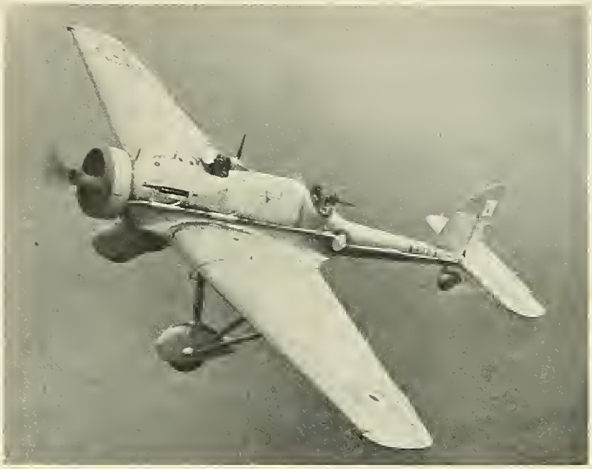
British Military Aircraft

(Part II)

●

PEYTON M. MAGRUDER

As pointed out in Part I of this article, the British Empire is one of the strongest powers in the air, having approximately 3000 combat planes. Previously, fighters and various types of bombers used by the R.A.F. were described.



Handley-Page 47

"Flight" photos

● Each classification of military aircraft for the Royal Air Force consists of a number of types—some obsolete, others obsolescent, and the remainder up-to-date and modern in every respect. New types in each class are being developed and delivered as quickly as they can be produced. These are described with each classification along with the older planes now in use.

Army Co-operation

The Hawker *Audax* differs from the *Hart* only in equipment. It is a two-place plane with a supercharged Rolls-Royce Kestrel IIS engine and may be used as a fighter, for observation or day bombing or for general utility purposes.

Except for equipment, the two-place Westland *Wapiti* is similar to the same type day-bomber, having a Jupiter engine which gives a maximum speed of 140 m.p.h. at 10,000 ft. Climb to 10,000 ft. requires 9.5 minutes and service ceiling is 20,700 ft. Normal range is 550-650 miles.

Bristol 142, (top) DeHavilland D.H. 89 (center) and Avro "Anson"

Experimental types of army co-operation planes are the Armstrong *Atlas,* the Avro *Rota* autogiro, and the Hawker *Hector.*

The *Atlas,* now used for training and experimental work, is practically obsolete. The two-seater *Hector* now being delivered to the R.A.F. is similar to the *Audax* and employs the Napier Dagger (24 cylinders in H form) air-cooled engine. It has a maximum speed of 185 m.p.h.

Reconnaissance and General Purpose Types

General purpose types carry a crew of two or three and are used as day- or night-bombers, torpedo carriers, dive bombers, fighters, ambulances, or for reconnaissance as the occasion demands. Some of the planes in this category fulfill all these requirements, but others are more specialized for certain missions such as dive bombing, torpedo bombing or reconnaissance duties while retaining characteristics of another type.

The Hawker *Hardy* is a two-place biplane adapted for use in India, Egypt and Iraq. It is fitted with a 575 h.p. Kestrel IB engine and is similar to the *Hart* except that it carries more complete and diversified equipment.

The Avro *Anson* is a low-wing monoplane with two 310 h.p. Siddeley Cheetahs. It has a maximum speed of 188 m.p.h. at 6,000 ft. and climbs to that altitude in 12 minutes. Its range is 765 miles with eight 20-lb. bombs or two 100-lb. bombs, and it has a service ceiling of 19,500 ft. The pilot's seat is in the extreme nose on the port side and the gunner-bomber is on his right in a prone position. Behind the pilot is a cabin with provision for radio, navigation, and photography.

There is an enclosed gunner's position at the aft end of the cabin, and guns are mounted to fire on either side of the cabin or directly downward. One hundred and seventy-five *Ansons* have been ordered for the Army.

Handley-Page 47's are two-place, low-wing monoplanes having a tapered circular fuselage aft of the observer. Stressed skin monocoque structure is used throughout. Fitted with a 665-690 h.p. Pegasus 3M.S. nine cylinder radial air-cooled engine, they may be used as light bombers, fighters, torpedo carriers or for army co-operation and reconnaissance work. The observer's gun has an unusual field of fire as may be seen from the accompanying photograph.

Although the D. H. *Dragon* is similar to the civil version, it carries three machine guns, bombs, cameras, radio and stretchers for ambulance work. An altitude of 1000 ft. may be maintained with full load on one engine.

The Bristol *120* fitted with a Pegasus M.2 nine cylinder radial of 670 h.p. for fighting, bombing, army co-operation, and photography may be used as an ambulance. The observer faces aft in an enclosed turret.

The Hawker *PV-4* is a two-place biplane powered by a Pegasus. It is designed and stressed especially for dive bombing but may be used for army co-operation, reconnaissance, and photographic work.

An experimental type is the Vickers *G4/31*, a two-place biplane designed as a general purpose day or night bomber or for torpedo bombing. A 650-690 Pegasus IIIM3 radial gives a maximum speed of 180 m.p.h. at 6,000 ft.

A development of the *Vildebeest,* the Vickers *Vincent* is a three-place general purpose bomber fitted with a 620 h.p. Pegasus IIM3 radial engine. It is used only in the middle East for tropical service.

The Vickers *Wellesley* is a high performance general purpose day and night bomber and coastal defense torpedo carrier. It is a two-place low-wing cantilever monoplane fitted with a 650-690 h.p. Bristol Pegasus IIIM3 engine. Fuselage and wings are of duralumin Vickers-Wallis geodetic structure, built up of intersecting members which are stamped out by machine operation. This type of construction is highly secret but is said to be considerably cheaper and lighter than any other known method. Added features are said to be its ability to resist gun fire without failure and the facility with which the component parts of the structure may be manufactured in mass production. An indication of the value of the *Wellesley* may be seen from the fact that the Air Ministry has ordered almost one hundred of these machines.

Fleet Spotter Reconnaissance

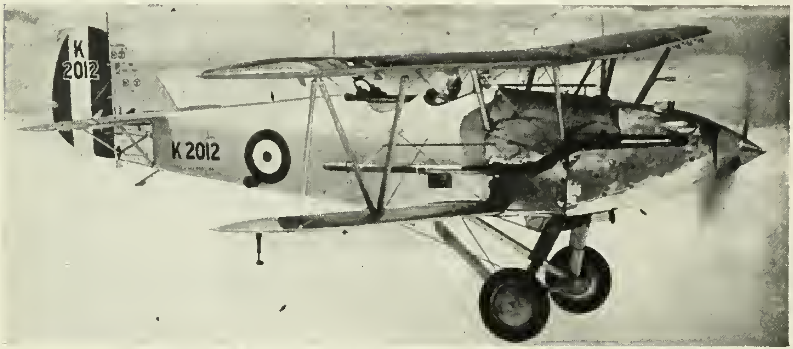
These types are designed for gun fire observation work and have a high ceiling, good visibility and long endurance.

The Hawker *Osprey* is a two-place fleet fighter reconnaissance biplane with a 630 h.p. Kestrel VI engine. While basically similar to the *Hart* day-bomber, it is adapted for operation from aircraft carriers and other ships by the landing gear which is interchangeable with twin floats and additional strengthening to withstand catapulting loads. It has folding wings and with the exception of the fabric covering is entirely of stainless steel.

For Naval use, the *Gordon* day-bomber is known as the Fairey *Seal*. It is fitted for catapulting and is equipped with flotation and arresting gear for carrier deck landings. It also may be easily converted to a land plane.

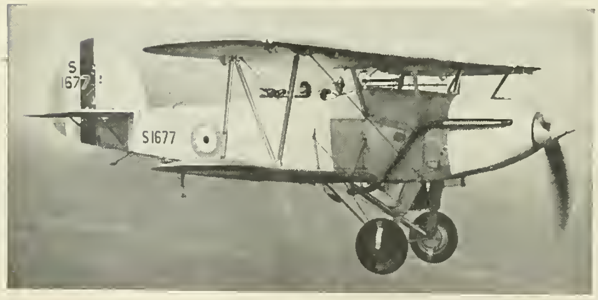
The Vickers *Walrus* is a 4-place amphibion with a Bristol Pegasus engine. It has a single-step, flat-sided hull with retractable landing gear. There are two gunners—one in the nose and one in the aft cockpit, both with moveable guns mounted on Scarff rings.

The Blackburn *Shark* is an experimental model with a Tiger radial air-cooled engine. It can be used as a two- or three-place torpedo bomber, fleet spotter, or reconnaissance type with floats or wheels. It has a maximum speed of 153



Hawker "Audax" (above) and Fairey "Swordfish" (below)

Hawker "Osprey" (below) and the Blackburn "Shark"



"Aeroplane" and "Flight" photos

"Flight" photos

Blackburn trimotored "Perth" and the Vickers Supermarine "Scapa"

m.p.h. at 5500 ft., service ceiling of 16,500 ft., and a cruising range of 550 miles. Armament consists of one fixed forward gun, one moveable gun, and a torpedo (18") or equivalent load of bombs.

The Fairey *Swordfish* is a new type torpedo spotter reconnaissance seaplane now being allocated in large numbers to the Navy. It is a two- or three-place unequal span staggered biplane of steel tube structure fabric- and metal-covered. It has a 665-690 h.p. Pegasus IIIM nine cylinder radial with Townend ring cowling and leading-edge exhaust-collector. Equipped for catapulting and carrier deck landing, it carries complete naval equipment and an 18-inch torpedo or an alternate load of bombs. The *Swordfish* has a maximum speed of approximately 180 m.p.h. and weighs about 8,000 lbs. fully loaded.

Coastal Reconnaissance

The Supermarine *Scapa* is a 5-place, twin-engined open-sea reconnaissance flying boat powered by Kestrel IIIM.S. 12-cylinder water-cooled engines mounted in monocoque nacelles attached to the under surface of the upper wing center section. There is a cockpit in the nose for a gunner-observer. The enclosed cockpit houses the pilot and co-pilot in side-by-side seats. Armament consists of three Scarff ring mountings and three fixed Lewis machines in addition to provision for 1000 pounds of bombs.

The Short *Rangaan* (a development of the *Calcutta*) has three Bristol Jupiters and carries three gunners, two pilots and a mechanic. The boat has an absolute ceiling of 14,000 ft., and an endurance of 7 hours at cruising speed, sufficient for a range of 750 miles.

The Short *Singapore* III has four Kestrels mounted in pairs. Its maximum speed is 145 m.p.h. at 2000 ft., service ceiling 15,000 ft., and cruising range 1000 miles. In the crew of six is a bomber-gunner in the nose, a gunner aft of the wings, and another in the tail.

The Blackburn *Perth* has three Rolls-Royce Buzzard water-cooled engines. With its crew of five, maximum speed is 133 m.p.h., ceiling 11,500 ft., and range 870 miles. In the bow are an automatic 1.5 lb. rapid-fire gun and a machine gun; two machine guns also are carried aft and the total bomb load is 2000 lbs.

Short "Singapore III flying boat (above) and the Vickers Supermarine "Walrus" (below)

Three latest models in this category are the Saro *Landan* and *Claud* and the Submarine *Stranraer*.

The *Landan* has two Pegasus III engines provided with Townend rings. It has a maximum speed of 135 m.p.h. at 6600 ft., a service ceiling of 15,000 ft., and range of 1105 miles at 115 m.p.h. There is a bomber-gunner in the nose firing forward and downward, and the other guns are amidships and in the tail. The hull is of the two-step type.

The *Cloud* is for training purposes and has two Siddeley Serval radial air-cooled engines. It cruises at 95 m.p.h., has a maximum speed of 118 m.p.h., a 14,000-ft. ceiling and a range of 5.5 hours. A large cabin is designed for a number of students, and 450 lbs. of bombs may be carried. There are also gun rings on the bow and aft compartments.

The *Stranraer,* reported as being a high performance type, has two Pegasus engines with Townend rings. There is a gunner-bomber position in the nose, an enclosed pilot's cockpit with dual controls, a radio operator, a navigator, and an engineer. Other gun positions are aft of the wings and in the tail. A torpedo is carried below the center section.

Transports (6 passengers or more)

It is interesting to note that the slowest top speed of six regularly scheduled American airliners (used on 95% of the airlines in the U. S.) is equal to or greater than the fastest British transport, excepting the *Camet* which was specially built as a racer and accommodates only two persons.

The present trend of British military aircraft seems to be definitely toward the development of certain classes, the most important of which are the long range bomber and interceptor fighter. A glance

(*Continued on page* 82)

The Personnel Problem in Aircraft Manufacture

(Part 2)

●

ROBERT E. CHANDLER

Courtesy East Tech High—Cleveland

Technical public schools adapt the youth for industrial practice

● Some of the possible fields in which aircraft producers might effect substantial savings through the development of efficient personnel organizations are outlined below. As mentioned before, however, every situation requires its own analysis, and as a result of this analysis, the development of its own program.

Employment

One of the most widely known (but not necessarily the most important) functions of personnel work is procurement of labor or man power. While the need of careful selection in hiring new personnel is apparent, the lack of care often exhibited in such work is astounding. In too many cases the only selection made is the scrutiny of an application and the necessary physical examination. Little or no effort is made to check on past records or to determine whether the applicant ever worked for the firm under which he lists his previous experience. Again the nature of the industry makes this difficult because the working personnel moves about frequently, and because time is generally an important element. The prospective employee has discovered this and many are using it to advantage in making false representations in applications.

The question is raised as to how such practice may be stopped and resulting losses curbed. The answer is not difficult. The same method used to determine the fitness of raw materials in aircraft construction can also be utilized to determine the fitness of a man for a particular job. In one case, physical tests and visual inspections are used; in the other, manual dexterity tests and examinations could be used to the same end.

Even though a man claims to have had considerable experience in aircraft work and may be able to produce verifying credentials, he is not necessarily a first-class workman. Another with less experience might easily be the more valuable employee, since background and training account for a great deal. Therefore, length of service is not a sound criterion even if time and trouble are taken to verify statements made on an application. The tests required for employment need not be long and complicated. In cooperation with department foremen short, concise, representative shop problems that would aid tremendously in the selection of desirable employees could be developed. Practically all phases of factory operation could be covered in this manner, and so minimize the "hire and hope" practices so often resorted to.

Boeing School of Aeronautics

Making a wood mold for forming sheet metal wheel cowlings

First Aid and Safety Programs

In most states laws cover, to a certain extent, the worker's safety. Proper guards are required on machines and various safety devices are used to advantage. In spite of these measures accidents occur. Invariably the cause may be traced to lack of proper precaution on the part of the injured person. Too often he does not know the hazards constantly present and has not been instructed as to how to avoid them. Every phase of work should be carefully studied and steps taken to acquaint the worker with all possible sources of danger. However, there are always careless employees who disregard sensible precautions. The aircraft industry is not an inherently dangerous one, but there are many workers who find their names on the State Industrial Compensation payrolls every year. There is no compensation system that fully repays either employer or employee for time lost through industrial accident.

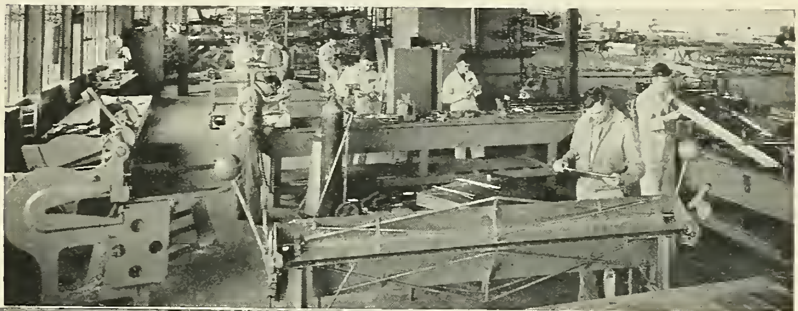
First aid facilities should be available at all times. In cases of severe injury medical attention should be obtained at once. Most aircraft plants are not sufficiently large to justify the full-time services of a physician, but an arrangement should exist whereby medical aid may be summoned whenever needed. Probably all that would be required for most organizations is a well-equipped dispensary and a qualified attendant.

Training Programs and Vocational Guidance

There has probably been less development in the field of vocational guidance than in any other part of aircraft personnel management.

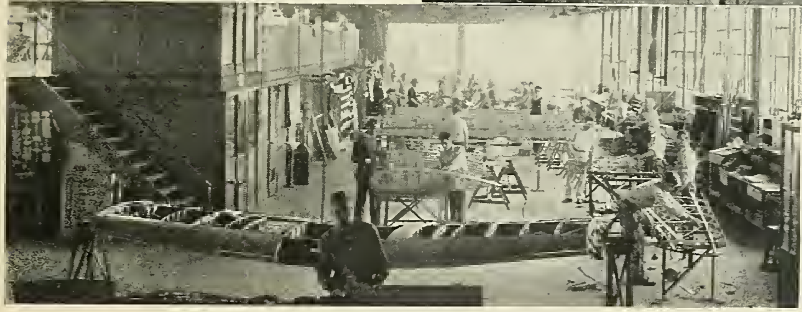
It was only a few years ago that there were no aircraft workers except in the military service. Where then have the thousands, who now gain their livelihood from this business of aviation, come from? They have come from other walks of life. Whenever the question as to where a good man for some particular phase of the work can be found suggestions are offered. Frequently some executive or supervisor says, "One of the best men I ever saw in that kind of work was a locomotive fireman before he came to work for me." Strange as it may seem such statements are not fiction. The analysis has not gone far enough, however. There have been other circumstances back of that phenomenon. Upon investigation one would probably find that that same individual was a good fireman, or could have been one if he had wanted to, and no doubt had obtained some valuable training from somewhere after he got into the aircraft business.

Airplane workers are not born for their jobs—they are developed. This development may be achieved in many ways, some good, others less desirable. Until recently about the only way for a person to acquire a thorough knowledge of aircraft manufacturing technique was to get a job, in some way or other, in an airplane factory. Once inside, the rest was largely a matter of fate. If he was fortunate enough to be placed in contact with other workers who knew their jobs and were willing to show him how to do his work, and if he was an individual who had the capacity for learning under such haphazard methods, he might eventually land on top. Without any or all of these "ifs" and "ands" he was out of luck. Eighty years ago it was believed that the best way of learning the law business was to secure a position in a law firm and learn by seeing and doing. Today we laugh at such a thought. Yet a great portion of aircraft workers who were hired during the past year learned what they know about the business in just that manner.



Parks Air College

Sheet metal work is best taught by the fabrication of various aircraft parts



Aeronca wings are fabricated in this department of the Aeronautical Corp. of America

Aeronautical Corp. of America

However, a few months of specialized schooling cannot make a first class factory mechanic of even the most intelligent young man. But it can, as in the case of other highly specialized occupations, give him a splendid background on which to build and develop. Today there are numerous schools, both private and public, that offer fundamental courses, and it is to these sources of potential man power for the future that the industry should look.

One cannot expect these schools to do the whole job and turn out a highly trained and specialized workman. The partially trained young man who receives no guidance on the job is little better off than the one with no previous training. Under either condition the outcome will be about the same. With a little guidance along with the work, and further specialized training, the man with previous technical training will develop much more quickly. That has been unquestionably demonstrated in similar industries to such a marked degree that many of the larger manufacturers maintain technical training schools.

One of the most perplexing problems of the industry from the standpoint of personnel training is the versatility that a good mechanic must possess. There are few factories building airplanes where the volume of production is large enough to permit training for specialized operations. Consequently personnel must be instructed and developed for a type of work, not for an isolated job.

Any comprehensive training program must be organized to care for the shifting of personnel that always takes place as a contract nears completion. Unfortunately all work is not finished simultaneously. As peak conditions pass from one phase of the work they tend to build up for others. This can be foreseen in advance and proper provision made to shift the better workmen from one job to another. It must be remembered that in making such changes the man cannot be expected to work as efficiently on the new job as he did on the old. In the same connection every possible attempt should be made to place him in the type of work for which he is best suited. Ordinarily he does best the thing he wants most to do. A wise employer will consider this.

Wage Incentives and Job Analysis

Very little is known and still less has been done along the line of job analysis and wage incentives for the aircraft industry. The immediate answer to any such suggestion is, "It can't be done in this business because the airplane is different." That was the same reply the machine tool people gave several years ago. Nevertheless many wage incentive systems are operating successfully for both employer and employee in many of those plants today. The industrial engineer claims, and justly so, that job analysis and wage incentive devices can be used in any industry where a product of a predetermined nature is being made. That stipulation handicaps him to a certain extent, but fortunately not continually.

Any system of wage regulation that would prove satisfactory for the aircraft industry presents one serious problem. That problem is to secure an individual in the organization who is sufficiently acquainted with the manufacturing operations to be able to accurately estimate base times. The development of this program is a matter that requires consideration and thought before being attempted. It is a field certain of future development as the industry grows, and one in which there will be decided advantages for the company and its workers.

Job analysis is a function of foremanship. The problems it presents are not as complex as those of wage incentive systems, although the two are closely related. Complete analysis would probably be practical for experimental projects in themselves, and where a production program is fairly certain of following soon afterward, would prove to be of great advantage for preliminary work. A complete job analysis is necessary where any attempt is made in the direction of an apprentice training program.

Labor Planning and Schedules

Planning of labor is essentially comparable to planning of material. There are three factors which must be provided for in the manufacture of an article. First, raw materials; second, machines or tools for processing this material; third, man power for operating the tools or machines. The care with which these factors are planned often determines the success of the venture.

In planning labor for a particular job or type of work there is the ever present problem of measuring the quality of the commodity being used. When one purchases raw materials he can specifically state just what the physical properties of that material must be. Upon receipt of the merchandise it can be tested for those qualities. Should it fail to come up to requirements, the purchaser either refuses to accept it or takes it knowing the weaknesses. The problem is not so simple when buying manual skill. However, the same principles that make it possible for the purchaser of raw materials to assure himself of a suitable commodity can be applied to the acquisition of labor.

The two problems have similar methods of solution. To determine material needs there is a bureau or department of the management whose duty it is to select the type and quantity required. This information is obtained from a study of the contemplated product, generally in the form of blue prints from the engineering department. In the same manner it is also possible to plan the labor needed to make the product. This is not so easily accomplished but nevertheless it can and is being done to profitable ends in hundreds of industrial plants today. There are, of course, other items to be considered in such a program, but an accurate solution is possible. The method of manufacture, which in turn is influenced by the volume of production, is one important feature. Plant equipment in the form of jigs and tools is another essential element. With proper consideration of these factors and knowledge of the product it is possible to make an analysis that serves as an accurate basis for labor estimates.

After the labor requirements are determined and the nature of the needed man power has been decided the problem then becomes one of procurement. Again the analogy to the material question is apparent. As the purchasing division knows where and on what terms raw materials can be obtained so the personnel department should be able to furnish similar information regarding manual skill. This information in itself is valuable in the design and manufacture of the product. Frequently design is regulated to avoid costly materials or those that are difficult to procure. But seldom is the acquisition of man power considered in connection with design.

Carrying the function of labor planning one step further it is easy to establish a labor schedule. In other words, if the requirements for man power are known, as well as the time when that labor will be wanted, all needs could be anticipated in advance. Such a program, however, depends entirely on a predetermined manufacturing schedule.

In its final analysis labor planning becomes a problem of determination of labor needs as to quantity and quality; the sources of skilled workers and their price; methods of selection of applicants to assure their qualifications; and the scheduling of the labor requirements.

Employee Services

The extent to which any organization enters into outside activity for its employees can be decided only by the management. In any discussion of such a program there are exponents of either side. Both may be correct in their arguments. There is no direct measurement of the benefits derived and therefore it is neglected or opposed by many as being an unnecessary and direct loss. Its value in the aircraft field is probably greater than in many other industries because the personnel of the industry moves about the country so much. Few workers remain in one community more than eighteen months or two years. This short period does not permit the development of social connections enjoyed by residents of long-standing. The employer should be, in such cases, more than just a purchaser of their services.

The justification for any such program, regardless of how extensive it may be, lies in two results. One is the increase in worker efficiency, or the prevention of the loss of efficiency, and the other the feeling of good will toward the employer. In too many cases the employer fails to recognize any responsibility toward the employee beyond the point of furnishing him a job and maintaining certain medical facilities prescribed by law. This does little to create a feeling of whole-hearted cooperation.

The extent to which the management should recognize its obligation to its help besides the job is a question which can be answered only after a study of the conditions surrounding each particular case. Due to circumstances, which at present seem peculiar to the industry, the need and value of such work is more keenly felt in the aircraft field than other industries of a similar nature.

There are certain things that are ordinarily taken for granted as being an obligation of the management. Probably outstanding among them is the adequacy of wash room and toilet facilities. Yet the lack of these essentials is sometimes appalling. The ordinary workman has considerable pride in his personal appearance. He may perform work requiring him to wear rough, unsightly clothing, but in most cases he chooses to leave these clothes with the job and not carry them with him beyond the factory gates. To do this he must have provision for changing his attire and for safely storing his street apparel during working hours. Hot water is another necessary but neglected feature. Where the above facilities are not provided the men are forced to resort to substitutes, often resulting in unsightly stowing of clothing about the plant, and creating an impression of disorder to the casual observer.

Beyond actual necessities, there is scarcely any limit to which the management may go in the establishment of services for employees. Of course, the point of diminishing returns is eventually reached and there such development should stop. Some activities and conveniences which have been advantageously used are company restaurants, recreation rooms, dormitories, shower baths and locker rooms, complete health service including the full time duty of a trained nurse, employee stock ownership programs, cooperative buying facilities, housing assistance and various other services.

Employee Activities

Although there are many fields and activities for the employee in which the management should participate, there are also others it should enter only in an overseeing capacity. These deal with personal relationships not directly connected with the actual job. Rules and regulations are necessary, and rigid enforcement imperative if a smooth operating organization is to be obtained. In many shops the worker is subjected to a dictatorial ruler who does not allow them a word in formulating the laws they must obey. Whether employers like it or not they must accept a certain amount of worker recognition. The growth of the American labor unions is evidence of the development of such recognition. The problems of the aircraft industry in this matter are no different basically from those of other industries. Many of them have found satisfactory solutions to their difficulties; others have yet to gain them.

Because aircraft workers change their place of residence so frequently there is a

(*Continued on following page*)

"They never take a chance"

Whether you fly a sport plane or operate a fleet of multi-motored transports, you can get oil and fuel exactly suited to your needs at leading commercial airports.

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(Continued from preceding page)

decided need for social activity. Coming into strange communities as they often do they naturally do not have the opportunity for social contacts that more settled individuals have. This is something that should be left entirely in the hands of the workers themselves. The only participation the employer need take is to encourage such activities and possibly offer suggestions as to proper guidance. The formation of teams for groups of workers interested in sports is one possibility for promoting personal morale among the employees. There are periods of frenzied activity in the aircraft business which necessitate long, tedious hours. If these are broken by diversion and relaxation for the worker he will be a more valuable man on the job. Basketball, golf, baseball, tennis, bowling, pistol clubs and various other sports are possible channels through which good-fellowship may be obtained. These should be self-supporting activities, planned by the men themselves rather than subsidized by the company. Facilities may be granted, but funds for their actual operation should be obtained from the members.

Public Relations

Any industrial organization which relies upon the community in which it is located for its labor supply must, directly or indirectly, deal with that community. Conversely, there are citizens who, though they have no real contact with it, are considerably interested in the company. This interest is probably keener toward the aircraft industry than others. There are continual requests for permission to see the factory from local residents as well as outsiders. Visitors should be shown every courtesy, though the management may never realize any financial benefit from the hours spent in such work. Requests are made because members of the community are interested in the enterprise. It is a gesture of friendliness and good-will that should not go unheeded.

In addition to those who come to see the plant there are others anxious to learn what the factory is doing. These may be civic organizations, clubs or schools. Contacts with merchants of the community, the doctors, the dentists and many others should be made. An employee may wake up with a toothache. He never went to any dentist but the one back home who, unfortunately, is some 2,000 miles away. What is he to do? He knows no dentist and only a few of his fellow workers. Wouldn't he feel kindly toward any organization that took a personal interest in him at such a time?

The value of these relationships cannot be estimated or measured in dollars and cents. Neither can one place a monetary value on a good neighbor in a community. Most residents like to feel that they have such neighbors, and also like to believe that they are being the same to their fellow men. A corporation should take the same attitude toward a community, especially when acts of friendliness are exhibited toward it. There are real benefits from those associations.

Conclusions

The aircraft industry has its problems in engineering, production, materiel, just as well as in personnel. As answers to these others are found through the application of well-founded fundamental principles, so also may solutions to the questions of personnel management be discovered. These problems require study before answers will be obtained.

The characteristics of the aircraft industry as it is today, and as it probably will be for some time to come, make the personnel problem somewhat different from that of similar businesses. Those peculiarities make the need for personnel work in aircraft more necessary than in the industries where it has already proved satisfactory. Whatever these new problems, they are capable of solution by students of personnel management who know the idiosyncrasies of the aircraft field.

Frequently objections are raised against the establishment of personnel organizations on the grounds that they will "sell out" the management through increased wages for everyone. To some that is all there is to the problem. Give a man a higher salary and he is satisfied. The problem goes much deeper than that. Often people of unlimited wealth are actually miserable. Money alone does not necessarily mean happiness. Neither does a high wage always mean a satisfied and harmoniously working personnel. One cannot be attained without a certain amount of the other. The aircraft worker, like any other wage earner, responds to the treatment he receives. In order to gain the utmost return for the labor investment the company must keep him contented and happy. The absence of strikes or violent disorders is no indication of worker satisfaction. The fact that an employee leaves his job means that he is not content, and should be a signal to the management to investigate the cause.

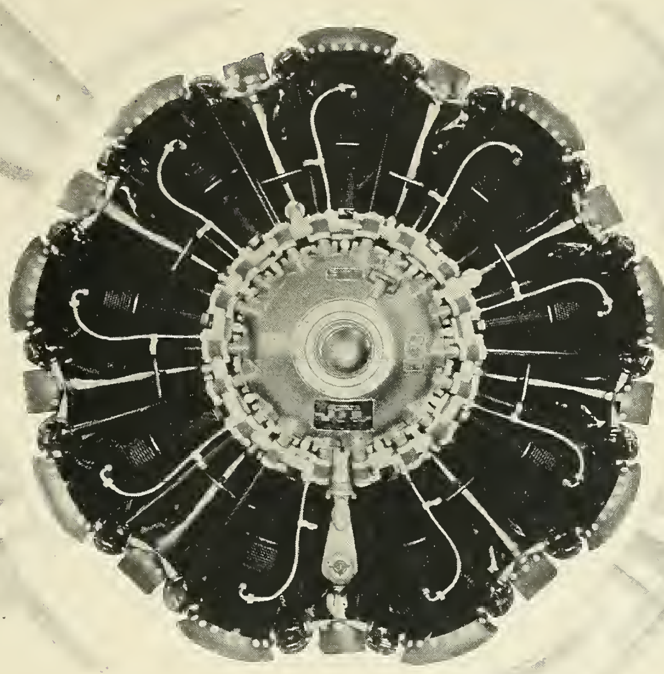
The various effects of lack of personnel control are far reaching. All are responsible for losses to the employer. Some losses are easily computed in values of dollars and cents. Others, less tangible and therefore less obvious, constitute just as real a loss as those more readily detected. A stranger visiting a plant for the first time may sense unrest or dissatisfaction among the employees while those who are in it every day fail to recognize it.

A Valuable Field

The science of personnel management is a relatively new field in industry. But it has proved valuable. There are still many who oppose such new-fangled ideas. Even they are conceding that perhaps it is all right in big corporations but not worth while in the small ones. There is a point where the benefits from such a division of the management do not justify its existence. That point, however, is far below the size of the leading American aircraft plants. Some of these manufacturers have recognized the need and value of such work in their own business and have made a good start. There still remains much to be done that will not only benefit the worker but the management as well. For the most part producers have been too busy to pay attention to intangible values derived through an efficient personnel organization. Ten years ago there was little being done in the way of production control and material planning. Just as surely as the industry has come to realize the worth of these phases of management, so it is coming to the proper management or control of personnel.

Typical assembly unit in a modern aircraft plant—the Northrop factory in Los Angeles

The New 1000 *Horsepower*
WRIGHT CYCLONES



Power the Latest U.S. Army Air Corps Bombers

Douglas Army Bomber (Official Photo—U. S. Army Air Corps)

Boeing Army Bomber

The new 1000 h. p. Wright Cyclone is the world's first 1000 h. p. radial, air-cooled engine in service operation. Engines of this type will power all of the latest Douglas and Boeing Bombers recently ordered for the U. S. Army Air Corps, as well as the new Douglas Super Transports.

The remarkably low fuel consumption of the 1000 horsepower Wright Cyclone supplements the low maintenance costs and reliability of this type of engine—established by years of active service duty with the U. S. Army Air Corps, the U. S. Navy and by 100,000,000 miles of airline operating experience.

Builders of Cyclone, Whirlwind and Conqueror Engines for the U. S. Army and the U. S. Navy

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A DIVISION OF CURTISS-WRIGHT CORPORATION

Sales Possibilities in South America

●

O. J. WHITNEY,

President, O. J. Whitney, Inc.

● An aerial trip through South America leaves varied impressions. Viewed aesthetically, there are the majestic Andes, the seemingly endless flat cultivated lands in some countries, the beauty of cities from the air, and the immensity of the almost impenetrable wooded and jungle lands which crop up here and there. It is not, however, the aesthetic story that interests us here. It is, rather, the possibilities for the development of aviation in this vast continent which lies so close to the South of us.

Contrary to general impressions, military aircraft are not used to the entire exclusion of private and commercial craft. It is common knowledge that there are a number of important airline companies operating over the Continent, chief among them being the American-owned Pan American and Pan American-Grace Airways, and the German-managed SCADTA. However, private and commercial flying is done on a somewhat restricted scale, not so much because the people are not sold on aviation, but perhaps because aviation has never been sold to them.

South and Central Americans not only need aircraft—they want them, for transportation in Latin America is extremely meagre. In some countries there are no railroads. In others, the railroads that do operate are slow to the point of exhaustion. In still others, the only means of transportation is the cumbersome steamer which is further handicapped by the circuitous routes that must be followed.

Abundant natural resources in South America have hardly been developed, solely because transportation facilities handicap greatly the possibility of doing so. The problem of getting produce to market is so complex that hundreds of thousands of dollars are lost annually. Mines, too, are confronted with the transportation problem, for it is practically impossible to get heavy machinery over the almost impassable roads.

Many South Americans have the financial means to develop these natural resources. They are stymied, however, when confronted with the task of rapid transportation. Frequent railroad washouts and swollen, swift moving rivers hardly minimize their difficulties. It is in these that the major opportunity exists for the American-manufactured airplane.

Some half-hearted efforts have been made to sell aviation in South America. Great Britain, France and Germany have already tapped the market, particularly Great Britain which thought enough of South American export possibilities to send its present King, then the Prince of Wales, there on a good-will aviation tour. It is nothing unusual to see Moth, Potez and Junkers agencies at many airports. On the other hand, we have partially failed to take complete advantage of our geographical position with relation to South America, or of our superior aeronautical products.

Last year, in October, a number of South American countries sent their aviation representatives to the United States. What these men saw here opened their eyes. It was difficult to believe that we had imparted so little information on what we had to offer in the aeronautical line.

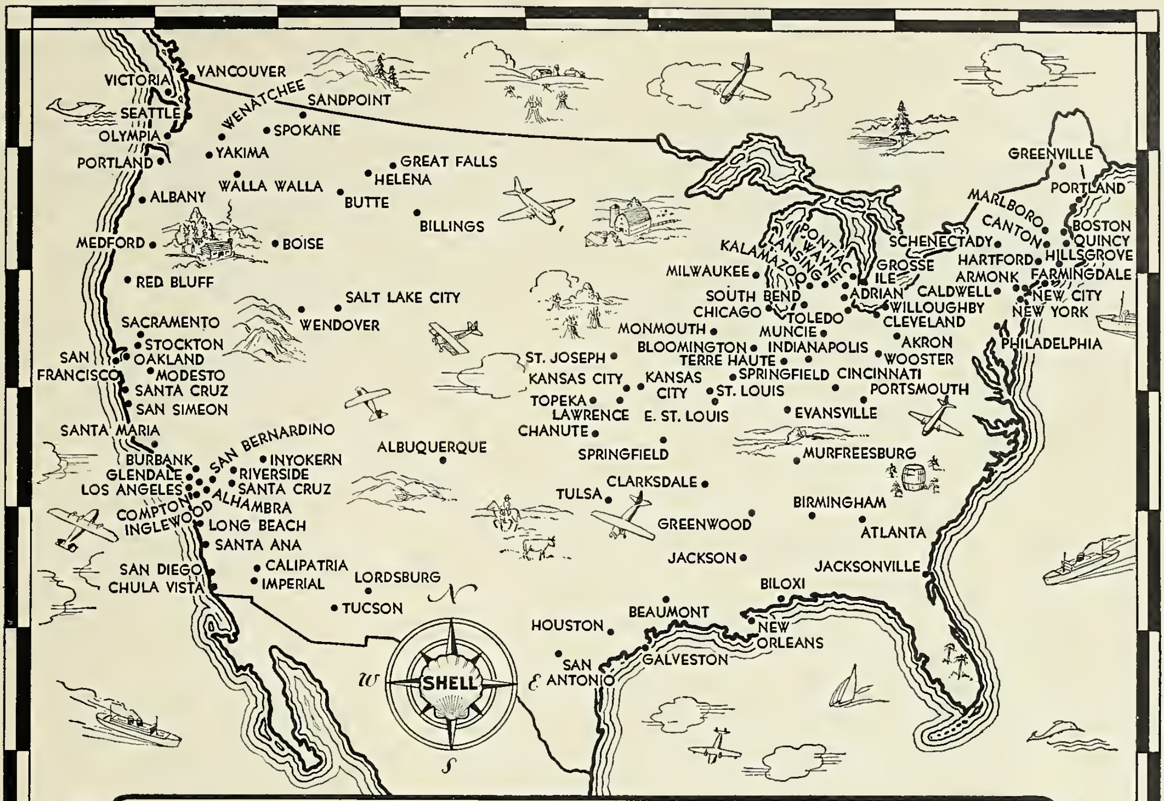
With the dual purpose of returning the courtesy of that visit, and of demonstrating to some extent what we had to sell, the author made a flight throughout South America during which he visited various countries and demonstrated the feasibility of using an airplane which would be capable of flying to any of these places. Accompanied by Burnham Litchfield of the Fairchild Aerial Camera Co., the author took off from North Beach Airport on January 4 in a Jacobs-powered Beechcraft equipped with a Fairchild Kruesi Radio Compass. Negotiations made with the Jacobs Aircraft Engine Co., Beech Aircraft Corp., Fairchild and Merrimac Chemical Co. (suppliers of dopes and aircraft paints) provided for the establishment of sales agencies in South America and for the demonstration of their various products. In addition, a Fairchild K3B aerial mapping camera was taken.

During the sales tour, which ended

(Continued on following page)

Ed Covey, manager West Indies Oil Co., Burnham Litchfield, O. J. Whitney and Richard Pierrot, Beechcraft agent in the Argentine

Whitney's Beechcraft upon its arrival at Havana, Cuba



At all these Airports–the balanced gasoline

ON long or short flights . . . nation-wide distribution by Shell gives the flier a ready source of the cleanest, most uniform and most dependable of all aviation fuels . . . Shell's balanced gasoline. For any type of aircraft, Shell supplies a balanced gasoline . . . with octane ratings from 73 up to the newly announced "100."

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SHELL

AVIATION SHELL GASOLINE

(*Continued from preceding page*)

March 19, a total distance of approximately 12,000 miles was flown, approximately 600 landings and take-offs were made, and 160 hours logged. In addition to demonstrations of flying characteristics of the Jacobs-powered Beechcraft, operation of Fairchild camera and Kruesi compass was shown. The Merrimac finish on the airplane also was noted in every country visited and information supplied as to its characteristics and durability. Before the trip was over, the Beechcraft and the aerial camera were sold to South Americans and contacts made with prospective purchasers practically assured additional sales. This point is made to illustrate the fact that American-made aviation products can be sold in this continent.

Sales Possibilities

Some definite observations as to sales potentialities were made. On the east coast, especially in the Argentine, the flat pampas country makes landing fields available everywhere. It is practically only necessary for any city within a radius of a thousand miles of Buenos Aires in the Argentine to designate as an airport any one of many fields surrounding a town. That is practically all they need to enable operations from it. In Buenos Aires, the author made the acquaintance of a well-known surgeon who has so arranged his airplane that he can carry a folding operating table and necessary operating implements. With a trained nurse and one of his associates, he sometimes flies as far as 600 miles from Buenos Aires to distant Estancia where he has been known to perform difficult operations. He has saved the lives of many patients because of his ability to get to them quickly.

The difference between the flat country of the Argentine and the extreme mountainous country on the west coast makes little difference to the airplane. The highways, however, throughout the Argentine, outside of the cities, are of a clay formation and after a heavy shower, or even a comparatively light rain, automobile travel is practically impossible or so slow that it is useless to try to get anywhere. The average speed would be approximately 20 miles per hour.

A boat trip from Buenos Aires to Rio de Janeiro takes approximately five days. The trip by automobile would probably take as long, if not longer, because of the existing roads and because of the necessity for clearing customs through Uruguay. By air it takes approximately eight to nine hours.

The growing civilian aviation industry in the Argentine deserves the attention of American manufacturers, inasmuch as expansion there is so rapid it is difficult to keep pace with it. Flying clubs, for instance, have sprung up in the principal cities, and on one week-end trip the author saw three or four private planes stored outside of a hangar. Even the smaller cities boast an airport and there is evidence of sufficient financial ability to buy and maintain good aircraft. There are more than twenty flying clubs and institutions subsidized by the state.

Military aviation in the Argentine in both services follows the lead of the U. S. Army Air Corps and Naval aviation. Proof that a plane has been accepted for the military divisions in the United States is generally sufficient incentive to the Argentine Government to purchase the same types for its respective services. It is also believed that Argentina has found it considerably cheaper to purchase American-made equipment rather than build it themselves, and has a definite preference for the products manufactured in the United States.

In Brazil there is a decided need of transportation to the interior and the government has shown its desire to help by subsidizing passenger and mail airlines. The growth of sport flying keeps pace with the establishment of airports in the various cities. In Brazil, as in the Argentine, there is plenty of evidence of money to be spent by sportsman pilots, and as additional airports are constructed, these people will be prospects for aircraft.

Brazilian military services are becoming more exclusively Americanized. Many of the pilots were trained at our military aviation centers, and they are familiar with the superiority of our equipment. A further point in our favor is the fact that the cost of our equipment is less than comparable equipment from Europe.

The West Coast

On the west coast of South America in Santiago, Ecuador, Peru and Colombia the same conditions are true with regard to the establishment of airlines, commercial operations and military requirements.

All along this coast transportation conditions are intolerable, at least from the Americans' viewpoint, and the following instance provides an excellent example of what the people are up against. One afternoon in Lima, a Peruvian from a city 150 miles back in the mountains came to the airport to see the demonstration and asked for a flight. From him I learned that transportation facilities to Lima by railroad took from two to two and a half days. When the railroad is washed out the trip can be made only by burro and this requires practically a week. With the modern airplane it would require about an hour. There is plenty of room to land the airplane in this locality and it is easy to see how important aircraft is to the people and industries in this locality and several others similar to it. The airline distances are short but the mountains are high and the jungles and swamps are difficult to negotiate. It makes a perfect set-up for air transportation. It is an easy task for an airplane to climb to the necessary elevations and get over the mountains safely.

While money is not quite as plentiful in this section as in Brazil and Argentina for sportsman flying, there is nevertheless a market available in the establishment of short feeder lines and general commercial operations that can be best served by American-manufactured aircraft.

The Peruvian government has devoted its attention to the development of aviation as a means of rapid transport, particularly in those areas which, by their nature, prevent the use of other means. The military aviation service is entrusted with the responsibility of carrying the mails within the territory of the Republic. Peru is a good country for all kinds of flying for at least ten months of the year, and with the establishment of a flying school at Las Palmas, there is a possibility of building up a market for private craft direct to haciendados and private individuals.

In Ecuador private aviation is as yet undeveloped, offering the American operator and manufacturer unlimited opportunities. Army officials and the President of the country are immensely interested in aviation and made an appreciative and attentive audience when the Beechcraft and Radio Compass were demonstrated to them.

American manufacturers can get business throughout South and Central America by going down there after it. Like Missourians, these people believe only what they see and it is apparent that demonstrations there will result in more and more sales every year. The most interesting phase of that market is that weather conditions are exactly the reverse of ours. Their summer is our winter, and since the largest part of sales in this country are made in the summer, we can therefore expect a large part of South American sales to be made during the same season of the year. A little business trip to South America in their summer and during our winter would be a tremendous aid in rounding out production schedules in the United States.

Fixed Base Operations

In addition to the possibilities of selling aircraft, there exists a market for the services of a fixed base operator. This is particularly true in the Argentine which is by far not only the most developed in civil aviation, but also is better adapted for flying than practically any country in South America.

A charter service similar to that offered by O. J. Whitney, Inc., would undoubtedly stand more than a fair chance of achieving success. This company maintains a fleet of 14 airplanes of various

(*Continued on page* 84)

KNOWING HOW

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Glass	*by Pittsburgh Plate*
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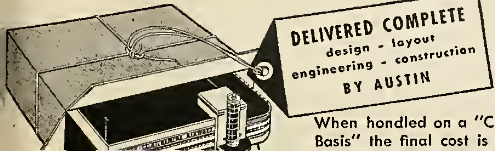

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OFFICES IN PRINCIPAL CITIES

Roosevelt School Doubles its Facilities

● To enter aviation 10 years ago, one usually had only to frequent some hangar and pick up the limited knowledge available. There was no effort to teach a well rounded course—or any course for that matter.

To meet a demand from those who wanted to learn to fly correctly, Roosevelt Flying School (as it was first known) was formed at Roosevelt Field. Following the history-making aviation events of 1927, Roosevelt Field was merged with the original Curtiss Field, under the ownership of Roosevelt Field Inc., which also acquired the school, and changed the name to Roosevelt Aviation School. The institution, under the influence of a paid in capitalization of $5,000,000 and public interest in flying, then began the service that has established it as one of the leading institutions of aeronautical training.

Increase in flying demonstrated the need for mechanics. It was realized that a good, well-trained man was as necessary to safe flight as a good, well-trained pilot, and so the Mechanics Division of the school was formed in 1929. For the first five years this school was conducted in New York City because of its convenience to a large population, with day and night classes and a short finishing course at the airport. However, the atmosphere of the airport was missing, particularly the daily contact with the very activity the student needs.

At the loss of nearly half the student body, the mechanics school was moved to Roosevelt Field in May, 1934, and merged with the flying division. The experience of two years of operation on the merged basis has proven the theory that a more practical training can be given at a busy airport. The fact is that the school has been forced by an increase in enrollments to double its facilities. The increase in training efficiency and the morale of both students and instructors more than justified the move. The school is government-approved for all flying licenses from Amateur to Transport and for all mechanics licenses. The Master Mechanics division is operated as a government-approved repair depot which permits the handling of a variety of licensed aircraft and engine work.

The school is owned and operated by the owner of Roosevelt Field. Its students have access to all of the advantages of the airport. The airplanes regularly hangared there (averaging about 200 now) offer a variety of activity and interest. More than 50 separate businesses, catering to every need of the flier, also provide close contact with aviation.

The purchase of modern and proper equipment and changes in curriculum to meet changing conditions of the industry are important. The chief responsibility, however, lies with the instructors. Roosevelt's long experience has enabled it to determine not only what is needed in the way of instruction, but to acquire a staff of experienced, understanding teachers who develop the ability and resourcefulness of the individual student.

Flying courses taught are the Amateur, Private, Limited Commercial and Transport, together with ground school lectures covering Air Commerce Regulations, Air Traffic Rules, Engines, Avigation, Instruments, Radio and Parachutes. Mechanics courses are Regular Mechanics and Master Mechanics. For those who want thorough training in flying and mechanics, combinations of both are offered. These may be taken simultaneously, as a flying schedule is arranged to fit in with the mechanics course. Flying students may start their training at any time, but mechanics and combination courses begin on specified enrollment dates.

In mechanics, each of the two courses offered has a definite objective. The Regular Mechanics course, which normally requires five months to complete, consists of primary instruction in airplanes, engines and welding. Its completion either qualifies the graduate for application of his knowledge in the industry as a mechanics helper, or forms the basis for his continuation in the Master Mechanics course. All told, the Master Mechanics course requires one year, in accordance with the Bureau of Air Commerce regulations for an approved mechanics school, before the student is eligible for the government test for his airplane and engine mechanics licenses.

Since the Regular Mechanics course covers the basic subjects of mechanical drawing, woodworking, wing building and covering, sewing, doping, masking, lettering, metal fittings, sheet metal work, cable splicing, tube cutting and fitting, and teardown, overhaul and rebuild of various radial air-cooled engines, all mechanical students entering the school, whether in Regular, Master or Combination courses, begin training at the elementary building.

Through the foundation acquired in the elementary division the student is prepared to fill a helper's position at repair depots, or factories. If he wishes to continue with advanced instruction, he enters the Master Mechanics course.

Few students fail to continue, when qualified, with the advanced instruction which eventually leads to the airplane and engine licenses. The Master Mechanics course provides for this.

The new school plant has been arranged to accommodate a large number of students and, at the same time, preserve the small group system of individual instruction. Each step in the course is separated from the next in departments. These departments are in turn so divided that only a small group works on each problem. Students particularly apt at certain subjects are not held back by others requiring more instruction. Thus, no student is forced to move along with a large class until he masters his subject.

The principal units of the school are an administration building, an elementary school and a master school. The first

(Continued on following page)

Official Photograph—U. S

U.S. NAVY ORDERS 40 ADDITIONAL Curtiss SOC-1 SCOUT-OBSERVATION PLANES

135 Curtiss SOC-1 Planes Delivered to the Navy During the Past 12 Months

The U. S. Navy Department has awarded the Curtiss Aeroplane & Motor Company an additional order for 40 Curtiss SOC-1 Scout-Observation Planes. This new order makes a total of 175 of the SOC-1 type ordered by the Navy Department during the past 15 months.

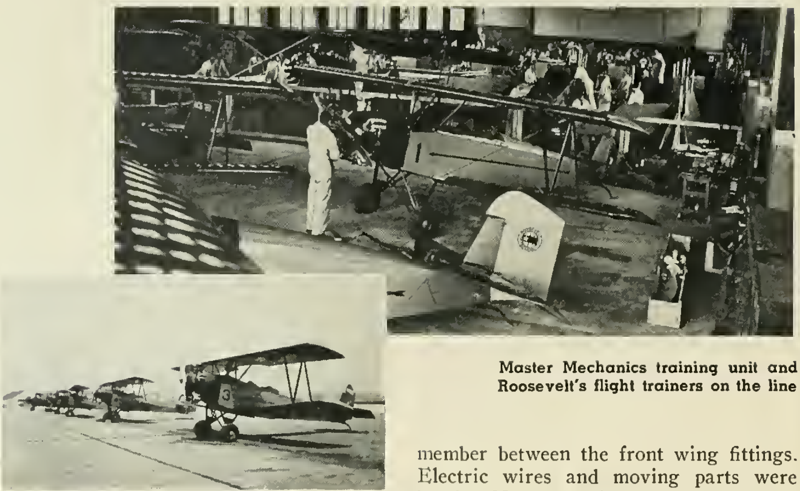
Curtiss has manufactured and delivered 135 SOC-1 planes to the U. S. Navy in less than 12 months. For the past several months deliveries have been made at the rate of one plane a day—a record for peacetime production!

The Curtiss SOC-1 is the new standard Scout-Observation plane of the U. S. Navy, designed to meet the exacting requirements of scouting and observation for battleships and cruisers. It is of rugged construction and incorporates features to provide low landing speed, unusually good control and maximum safety to its crew when operating under adverse conditions at sea.

Official Photograph—U. S.

CURTISS AEROPLANE & MOTOR COMPANY, IN

BUFFALO A Division of Curtiss-Wright Corporation **NEW YORK**



Master Mechanics training unit and Roosevelt's flight trainers on the line

(Continued from preceding page) contains a student lounge for flying students, dressing and locker rooms, and the offices of the School Director and the Registrar. The elementary school is housed in a well-lighted building containing lecture rooms, instructors' offices, instrument room, and the drafting, woodworking, metal and welding, covering and finishing (with a modern dope room adjoining) and the engine sections. The student spends some five months here and is then ready for his examinations for his Regular Mechanics certificate or promotion to the Master Mechanics school.

The Master Mechanics division is housed in one of the largest buildings on Roosevelt Field. In addition to hangar space for several of the school training planes, the sections or departments are much the same as in the elementary building, except that the student works on licensed aircraft and engines being rebuilt or repaired for actual service.

In most instances, with the exception of a repair or re-covering job, airplanes brought into the school require complete stripping and dismantling before they are rebuilt. Usually six students are assigned for this work. No endeavor is made to speed repairs beyond the ability of the student to do his work professionally. These rebuild and overhaul problems often require alterations involving practical engineering, and here the student's ability to make sketches and read blue prints is helpful.

An illustration of the scope of practical work undertaken, the amount of detail encountered in such work and the consequent training provided is found in the recent conversion of a Fairchild FC-2-W-2 at the school from a passenger carrying to an aerial mapping airplane now doing service in Texas on a mapping assignment.

Wings, struts, tail surface, landing gear and engine were first removed, and then the seats, floor boards, baggage compartment and instrument panel board, so that the plane was stripped to the tubing. This skeleton was examined and a broken diagonal brace tube at the fire wall replaced. The interior of the fuselage tubing was re-oiled. The structure was cleaned, primed and painted. New floor boards were installed, extending one bay further to the rear than the original. Two camera holes were made in the floor boards, one with a 13½" opening in the forward end and one with a 20¾" opening in the rear, with two view-finder holes and plugs, all according to U. S. Army Air Corps specifications. Camera mounts were made and installed and lens rings fitted in the openings. The interior of the cabin was then upholstered. All three doors were rebuilt to a 2" thickness and the two rear doors fitted with detachable glass panels. Safety glass was installed in all windows, with one 12" × 12" skylight over the rear camera hole, and a large glass pane in the bottom cowl under the pilot's seat. Heaters were set in on both sides of the pilot's cockpit. A battery box was fashioned and fitted under the pilot's seat. A main fuse and switch, and an electric starter were then installed. An 18" radio mast was erected on the top of the cabin directly in front of the center fuel tank and secured by clamping to the cross member between the front wing fittings. Electric wires and moving parts were bonded. New control cables were made up and installed throughout. The fuselage was then re-covered with fabric. A new shockproof instrument panel was fashioned and an altimeter, airspeed indicator, compass, directional gyro, tachometer and bank and turn indicator connected in the proper places, together with a head temperature gauge, generator control box, voltmeter, ammeter, wobble pump and fuel pressure gauge. New cowling was then fashioned, and the covered fuselage and cowling doped and color sprayed.

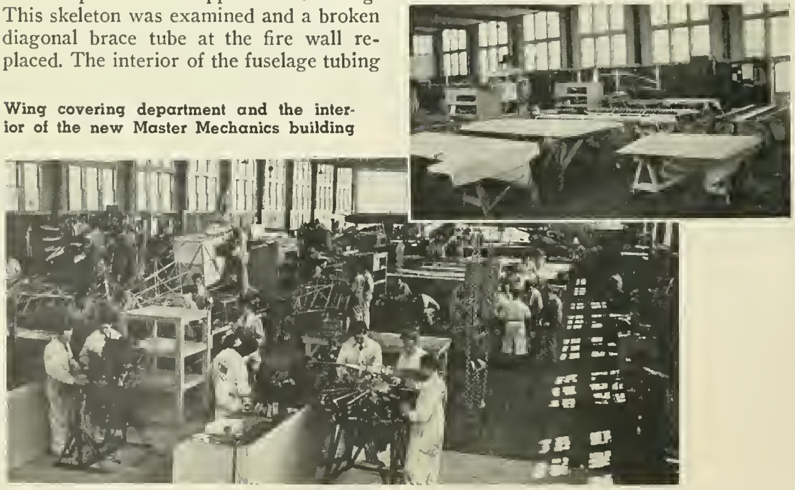
While this work was being done another group of students had stripped the fabric from the wings and tail surfaces. Repairs were made on the wings and the tail surfaces reworked. These structures were then primed and painted and the wings rewired for navigation and landing lights. Fuel tanks and lines were repaired and installed in wings. The structures were then re-covered with fabric, doped, and sprayed. Wings were then masked and lettered. This same group reworked all struts and fittings, relined the brakes, reworked the oleo gear, rerivetted the wheels and assembled the undercarriage of the fuselage.

Still another group concluded a major overhaul on the 450 hp Wasp engine. This involved a new master rod bearing, six wrist pin bushings, four new wrist pins, rebushing of the cam mechanism, two new pistons, new piston rings, new valve guides and re-seating of valves, new thrust bearings and overhaul of magnetos and carburetor.

The propeller was etched, coated, balanced, tracked and mounted after which the engine was given a block test with the students making out the usual reports.

The entire airplane was assembled and rigged. It was then test flown and relicensed.

That this training is effective and of the type demanded by the industry is evidenced by the fact that graduates of this school are today employed by a number of leading aeronautical concerns in this and foreign countries.



Wing covering department and the interior of the new Master Mechanics building

Constructive Plans of State Aviation Associations

●

GEORGE ORR

Honorary Chairman, The New York State Aviation Association

There is need today for cooperation and organization by pilots and operators to ward off legislation detrimental to the best interests of aviation, and for joining forces in promulgating constructive aviation laws. Associations already formed for this purpose in a number of states are meeting with encouraging results, but more are needed in order to be more effective. Properly organized groups within the states should be comprised of sincere aviation people and not political hangers-on, as is too often the case where vigilance is relaxed. There is an ever-present job to be done if aviation is to continue its development without political interference and AERO DIGEST is therefore devoting space each month to deal with the activities of existing associations believing that it will enable new groups to determine the most advantageous procedure to follow. Organizations and individuals concerned with state aviation affairs are invited to use these columns as a clearing house for imparting and gaining information useful to the purpose outlined.

● Unquestionably, there is a field of usefulness for a state aviation commission—and the demands on such commission will increase as flying activity increases. The problem is to keep such a commission as an aviation commission and not a political commission. Unfortunately, the trend of modern politics is to create as many jobs as possible, and in justifying these jobs the tendency is to provide much more regulation than aviation needs at present. Such over-regulation is bound to have a harmful, retarding effect upon flying activities. Adequate regulating machinery is costly and must be reflected in higher taxes, either on the general public or, as may be confidently expected sooner or later, on flying itself.

Not Primarily Regulatory

The present need for a state aviation commission is not primarily regulatory. The Bureau of Air Commerce has developed an effective and intelligent system of control, both for the regulation of the flier and for protecting the public. The weak link in this system is the fact that there cannot be sufficient federal inspectors to personally enforce its regulations in all parts of all states at all times. The same criticism would be made of the inspectors of a state aviation commission unless personnel were so numerous that the cost would be out of proportion to the value of the end in view.

The only regulatory system that adequately covers all of any state at all times is the police system. This is already established and paid for. The only practical arrangement, therefore, is to make the police the agency for enforcing aeronautical regulations. This may be done by adopting laws similar to federal regulations as state laws and their enforcement would thus be undertaken by agencies that already enforce other laws.

The demand for a state aviation commission, at the present stage of aeronautical development, is a demand for promotional rather than regulatory activity, and for constant, intelligent and sympathetic study of present problems and of new problems as they arise. This gives the commission that undertakes such a program plenty to do.

Much federal money has been available recently for the construction and improvement of municipal airports and airway landing fields. A commission needs no regulatory power to study its state-wide needs and offer a comprehensive program as to where such developments are needed and practicable. Interest in the communities affected must be promoted to secure action based on public demand. When action is secured, the plans and program should be guided by the commission. Because of its experience and knowledge of the state-wide plan, valuable assistance could be rendered the community in planning the improvements. When the plan is ready, assistance could also be rendered in placing the community in touch with the proper government agency and in following the correct procedure.

Contact with Industry

A state commission could—if it would—maintain close contact with the industry and fliers throughout its state. This could be done through hearings, to which representative persons are invited, and through daily contact with those who fly. The federal regulations, which probably have met with more genuine satisfaction and voluntary support than the efforts of any other department, were formulated along those lines. Being based on actual needs and an intimate contact with practical operators, the regulations are practical and receive the support of those affected. A state program, based upon similar contact with the industry, could be just as practical and receive the same sympathetic support. Recommendations to the legislature would be so authoritative that they would merit and carry weight. The commission would have tremendous influence in fostering helpful legislation and in keeping harmful and unnecessary legislation off the statute books.

In lieu of building up an expensive enforcement structure, there is a splendid field open for the commission to undertake to inform the police of the state as to aeronautical regulations and how to enforce them. Many shudder to think of entrusting the usual cop with power to regulate flying, for few of them know anything about it. But they are taught to enforce other laws and they can be taught to enforce aeronautical laws. That's another important function of the state commission. Properly instructed, the police force of a state can give far more complete protection to flier and public than any corps of inspectors a state commission can hope to support.

Personnel Requirements

All of which brings us to the crux of the matter: the personnel of the commission. If it is to be political—appointed for political reasons and guided by political forces—it will be hopeless from the first. Naturally, to come into existence it must be created by the legislature and appointed. The best safeguard is to have the commission appointed by the Governor, with the consent of the Senate. A majority of the members must come from those engaged, and who have been engaged for several years, in the industry as their major occupation. This will give a knowledge that is essential and a sympathy that is just as necessary. Their terms should be for several years, say five, and only one expire each year so that there will always be a majority of experienced commissioners on the board. Such a commission, if sufficient interest is shown in getting wise appointments, should be safe to do the constructive job that is possible and to promote favorable aviation laws.

AVIATION ENGINEERING

DR. ALEXANDER KLEMIN • GLENN D. ANGLE • DR. MAX M. MUNK • DR. MICHAEL WATTER

LOCAL REINFORCEMENT OF WING BEAMS

●

GARRETT COVINGTON

The accompanying article deals with a frequently neglected but important point in the stress analysis of a wing beam. The method is one developed by the author and which be found useful in his work as a stress engineer. It bas proven itself useful not only in tbe design of new beams, but in overhaul work in which the beams have shown failures of this nature.

● Wood construction of wing beams has become practically obsolete except in small light airplanes, with current development in this country being toward the monocoque type for internally braced, heavily loaded wings, and built up aluminum alloy beams for externally braced and more lightly loaded wings. However, the wooden beam had at least one advantage over its modern successor—it was a comparatively simple and inexpensive process to vary its cross section from place to place along the span, thus building up the more highly stressed portions of the beam and lightening that portion where the load is small.

The same can be done with an aluminum alloy beam, but the process is less simple. The wing beam can be built throughout its length to the strength required at the point of maximum load and then lightened at points of lower stress. This procedure is expensive and results in inefficient sections at many parts of the beam. An alternate method is to build the entire beam of a lighter section than that required at the maximum load point and then to add reinforcing plates where necessary. This method is generally used and it results in a beam composed of a number of small parts fastened by rivets.

A common cause of failure of such a beam is the shearing of rivets between the component parts. This is most likely to occur in beams having intermittent cover plates riveted to the top or bottom flanges. In these failures, the rivets near the ends of these cover plates shear off, although the combined shearing strength of all the rivets that fail is invariably greater than the tensile strength of the plate. Despite this fact, in most cases the plate is undamaged and in the balance of cases the rivet holes show bearing failures and in no instance does the plate show signs of a tension or compression failure. These facts indicate what is known as a progressive failure of the rivets; that is, the end rivets fail first, suddenly throwing their load on the next rivet, which in turn shears off and throws the load to the next.

It is possible, by an analytical investigation, to develop a rational method for the design of the tip of a cover plate. Such a method must determine the number of rivets required and place them in such a manner that progressive failure of the rivets is avoided. As a basis upon which to start this investigation, a beam is assumed with the following characteristics:

I = moment of inertia of beam including cover plate
S = section modulas of beam including cover plate
M = bending moment at any point
A_1 = area of cover plate
A_t = total area of beam including cover plate
P = end load in beam.

Calculate M_1 the bending moment at the point at which it is desired to cut off the cover plate. The stress at this point is:

$$f = P/A_t + M_1/S$$

The whole of the cover plate, in almost all cases, lies close to the outboard fiber. The total load in the cover plate, then, should be

$$P_c = f\,A_1$$

It is apparent that, neglecting friction, there must be a sufficient number of rivets between this point and the end of the cover plate to carry this load. Thus the number of rivets required beyond any point in the cover plate may be expressed as

$$n = f\,A_1/R$$

where R = strength of each rivet
f = cover plate stress at this point
A_1 = area of cover plate at this point

An examination of this formula shows that R is a constant and that f is practically a constant within the length required to insert n rivets. To avoid a progressive failure of the rivets, the area (A_1) of the cover plate must be cut down so that at all points in the tapered section the area $\leqq nR/f$ where n = number of rivets between that point and the tip of the cover plate.

This can be further simplified by the substitution of bt for A_1 where b = width and t the gauge of the cover plate. The formula then becomes

$$b \leqq Rn/ft$$

The foregoing analysis assumes that the bending moment, section modulus, and beam area remain constant through the tapered portion of the cover plate, these conditions being equivalent to a constant cover plate stress in the interval. The effect of this approximation is usually negligible, but actual conditions may be allowed for by an obvious refinement if desired. Rivet slip, which has also been neglected, renders the formulae conservative, since it tends to unload the most highly stressed rivets.

The development given above shows that the progressive type of rivet failure can be eliminated by tapering the ends of the cover plate in such a manner as to stress the rivets equally, and by providing a sufficient number of rivets in the tapered section to transmit into the cover plate its full load. The design work required can be done in five minutes; the extra cost in the ship is negligible; and there is a slight saving in weight. Therefore, an actual analytical check of such

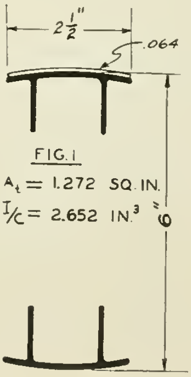


FIG. 1

$A_t = 1.272$ SQ. IN.

$I/c = 2.652$ IN.^{3}

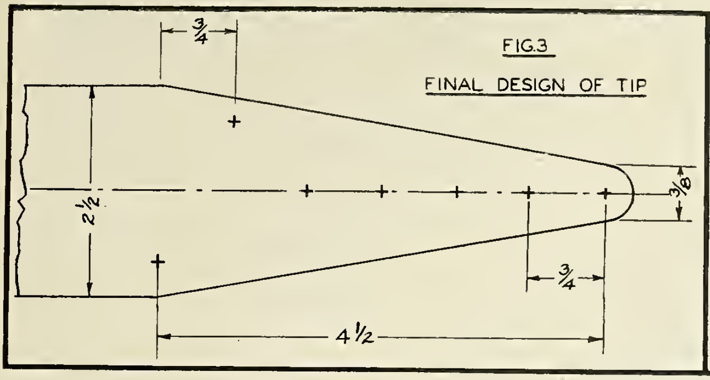


FIG.3

FINAL DESIGN OF TIP

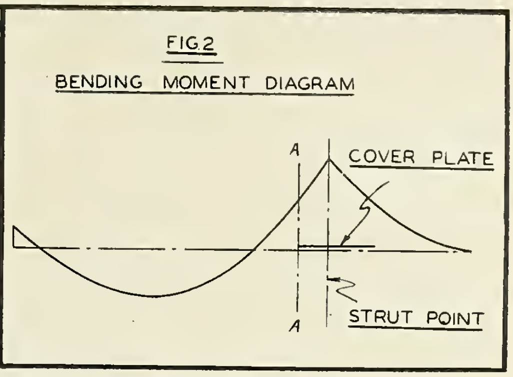


FIG.2

BENDING MOMENT DIAGRAM

a joint is recommended as it may save considerable time and cost of retesting a beam. The method readily can be expanded to include the effect of reinforcing the beam with a dissimilar material. An actual example of the use of the method outlined above is as follows:

Given: A beam with the cross section shown in figure 1 and the moment curve shown in figure 2. It is desired to discontinue the .064 cover plate at point A. What are the details of the plate tip?

$M_a = + 45{,}000$ in. lbs.

$P = — 10{,}300$ lbs.

Stress at A

$f = P/A_t + M_c/I = 10{,}300/1.272 + 45{,}000/2.652 = 8{,}100 + 17{,}000 = 25{,}100$ lbs./sq. in.

Area of cover plate

$A_1 = 2\frac{1}{2} \times .064 = .160$ sq. in.

Number of rivets required inboard of A

$n = f\ A_1/R$

Assume 5/32" rivets used; strength of rivet $R = 575$/lbs.

$n = 25{,}100 \times .160/575 = 6.98$ or 7 rivets.

Use 2 rivets at A and place the balance in a line down the center of the beam. The maximum width of the plate at the first rivet is:

$b = Rn/ft = 575 \times 1/25100 \times .064$
$<$
$= .358''$

At second rivet:

$b = 575 \times 2/25100 \times .064 = .716''$;
$<$
third rivet $= 1.074''$; fourth rivet $= 1.432''$; fifth rivet $= 1.790''$.

As a check, we can verify from the layout (Fig. 3) the width of the plate at the fourth rivet:

Check:

$b = .375 + 2.125 \times 2.25/4.5 = .375 + 1.062 = 1.427''$ which is practically equal to the width required by the total shearing strength of the rivet at this point, indicating a satisfactory design.

Digest of Technical Articles from Foreign Publications

Tail Buffetting

Full-Scale Tests on the Longitudinal Control of A Low-wing Monoplane With Special Reference to Wing Wake.—By J. E. Serby, B.A., and R. P. Alston, B.A. Communicated by the Director of Scientific Research, Air Ministry. Air Ministry (Great Britain) Aeronautical Research Committee Reports and Memoranda No. 1666, November 9, 1933.

This report presents the results of extensive flight tests and wind tunnel experiments made with the intention of curing air interference phenomena encountered in a certain low wing airplane. At high incidences the tail vibrated badly and the longitudinal control was poor. Work in flight was mainly confined to measurement and visual observation of these phenomena as they manifested themselves at the wing root and at the tail plane. The development of turbulence at the wing root was studied by cinema records of wool tufts, and was extended to include the spread of turbulence over the whole wing culminating in the stall. The loss of total head over a vertical section near the tail plane was measured. In addition it was possible to conclude from several different sets of measurements that the wing-body turbulence was strong enough to produce a double lift curve, the alternate flows associated with which could be maintained in flight, over a small incidence range much below the final stall. The work developed more as a study of a defective wing-body-tail combination than an attempt to effect a complete remedy.

Aerodynamics

Aerodynamic Reactions on Airfoils Oscillating in a Uniform Air Stream (Le Azioni Aerodinamiche sui Profiti di Ala Oscillanti in Presenza di Corrente Uniforme, Memoria di Placido Cicala, Memorie della Reale Accademia delle Scienze di Torino, Serie 2, Parte 1, Tomo 68.)

The author first reviews briefly the present state of the problem referring to works of Birnbaum, Wagner, Glauert and Küssner on the effect of aerodynamic reaction of an oscillating airfoil. Then he presents a method for the calculation of the distribution of circulation over the airfoil and of the coefficients of forces which act upon the profile. An analysis is presented of the dissipation of vortices in the outflow portion of the stream. The results are compared with the proposed approximate treatment of the problem and the results of experimental investigations.

Landing Gears

Retractable Undercarriages, By George H. Dowty, M.I. Ae. E., A.F.R. Ae. S. The Royal Aeronautical Society. (Advance proof).

The author presents a historic-technical review of the retractable landing gear, tail wheel and wing tip float. The article gives an extensive presentation of the latest types and is profusely illustrated with schematic drawings and detail features of the mechanisms used. The titles of different sections of this paper are given below to indicate the subjects covered.

Some early sign posts; design requirements; retracting mechanisms; operating systems; emergency lowering mechanisms; safety locks; position indicators; tail wheels.

Design

Basis of a Transatlantic Airplane Program (Bases d'un Programme d'Avion Transatlantique, A. Verdurand, L'Aéronautique, No. 203, Avril, 1936).

The author presents a brief study of the comparative performance of possible types of flying boat designs specifically applicable for trans-Atlantic service. He proposes three types of flying boats, namely, the high seas, the marine and the "variable." As defined by the author the first is capable of taking off and landing under high seas conditions, while the second although it can be landed on high seas cannot take-off in rough water. The third type is also capable of landing in rough weather, but for the take-off it requires auxiliary means such as catapult, launching platform or some other accelerating device. The article includes the effect of both the explosion and heavy oil type engines and the performance and operation characteristics of six designs tentatively arrived at by Chautiers Aéro-Maritimes de la Seine in connection with the problem of the trans-Atlantic flying boat.

Stress Analysis and Vibrations

Structural Strength of Airplanes in Relation to Greater Speeds. (La Robustezza dei Velivoli in Relazione all'Aumento di Velocita, Generale de Genio Aeronautico, Dott. Ing. Amodeo Fiore, III Congresso Nazionale degli Ingegneri Italiani, Trieste) Rivista Aeronautico, No. 4, Aprile, 1936.

The author of this paper, presented at the National Congress of Italian Engineers, points out that the greater speeds attainable with modern aircraft impose new considerations of strength requirements. While in the past it was satisfactory to limit the structural design to static conditions of loading, properly verified with static structural tests, present conditions of aircraft operations indicate the importance of vibration and dynamic loading. The paper suggests an additional phase of structural design which the author calls *The Elastico-Dynamics of Aircraft* or *The Theory of Aircraft Vibrations.*

The author studies the various natures of possible vibrations such as free and forced, vibrations of different parts of the airplane, influence of gusts, etc.

The complexity of the problem explains the somewhat slow progress of these studies which to date are still somewhat in the sphere of theory and physico-mathematics.

The paper summarizes various specific problems, presenting in non-mathematical language the general conclusion reached so far.

Metal Construction

Application of Built-up Sheet Metal Construction in Aircraft (Les Tolês Composées et leurs Applications à la Construction Aéronautique, Robert V. Le Ricolais, L'Aéronautique No. 201, Fevrier 1936).

The article presents an outline of the method of composite sheet metal construction as applied to aircraft. The author points out that there are two fundamental schools of structural design—one preferring the use of special structures intended to provide the strength of the whole, and the other in which the strength is provided by the appropriate construction of the shape-forming assembly. In the case of aircraft, the latter method is confronted with the difficult problem of form failure inherent to thin gauges which are required by the necessity of weight saving. The *Isoflex* type of design described in the article attempts to solve this difficulty by the use of composite corrugated sheet metal joined in a way to obtain uniform resistance characteristics of the built-up unit. The author feels that this method of construction enables easily accessible and formed monocoque type units. It is particularly adopted (in the authors opinion) to take care of elastic deformation and is excellent for sudden shocks and reversible loads.

Flaps

The Use of Split Flaps and Other Devices for Facilitating Landing. By S. B. Gates, M.A., Air Ministry (Great Britain), Aeronautical Research Committee Reports and Memoranda No. 1659, *April,* 1934.

The following summary is given in the report. "In these notes the evidence of recent experimental work from many sources on the characteristics of split flaps and other devices for increasing gliding angle and maximum lift coefficient is collected and summarized. It is related to the practical problem of giving the pilot an easily controlled means of spoiling the cleanness of his aircraft and decreasing its stalling speed when he comes in to land. The evidence, so far as it goes, suggests that the problem is soluble, either with a split flap or with a slotted flap, without disturbing the action of conventional ailerons. The slotted flap has the advantage of lower drag at the smaller flaps angles and thus makes it particularly suitable for improvement in take-off, and in addition, due to its extremely light hinge moments, it has the added advantage of an easy method of balancing the air loads. The data includes results at high Reynolds numbers, also effect of flaps on longitudinal stability and hinge moments on some types of flaps."

Aerodynamics

Built-in Twist in a Tailless Project (Lo Svergolamento Cosstrutivo nel Projetto di un Senza Coda, Ing. Ezio Lorenzelli) L'Aerotecnica, Volume XVI, No. 3, *Marzo,* 1936.

The practical appearance of wings with variable surface may possibly eliminate the only serious defect of a tailless type, namely the low maximum lift. The all-wing design once more seems to be one of the possible answers to the problem of long-range, fast aircraft.

The author considers an all-wing design which incorporates sweepback and built-in twist. This design enables one to obtain proper spanwise lift distribution and to arrive at a condition of stability which is perfectly analogous to a standard type. In fact, stability behavior in a tailless aircraft is indicated to be of a more positive nature than ordinarily is the case in the present conventional airplanes.

The paper gives general formulas to determine analytically the aerodynamic center of the wing, the aerodynamic moment due to the twist and sweepback, as well as the conditions of equilibrium encountered in this arrangement. It also gives a method of successive approximations to determine the aerodynamic characteristics of a twisted wing in the region of angles approaching the burble point.

Aerodynamics

Lift Increasing Devices (I Dispositivi d'Ipersostentazione, Ten. Col. G.A.R.I. Carlo Alippi, Cap. G.A.R.I. Antonio Eula, Rivista Aeronautica, N. 3, Marzo 1936).

The authors consolidate in this article the data on various types of lift increasing devices and analyze the advantages offered by different arrangements. The article contains an interesting chapter on desirability and handicaps offered by automatic and controllable devices and stresses the fact that individual requirements dictate the proper choice of arrangement. The content of this paper indicates the broad treatment of the subject: purpose of lift increasing devices, aerodynamic requirements to be met, cause of the lift loss, means to delay lift decrease, types of lift increasing devices, trailing edge flap, slotted flap, fixed front slot, effect of slotted wing decrease on landing speed, stability and control at low speed, glide angle increase, decrease in the take-off run, effect on normal flight characteristics, conclusions.

Air Transport

Airplanes for Air Transport (Les Avions de Transport, Maurice Lenoir, L'Aérophile, Fevrier 1936).

The author analyzes in this article principles of comparison of transport airplanes, applying his method to different French, American and German airplanes and, finally, draws a parallel with other means of transportation. The article first sets out to determine the expression for efficiency of transport airplanes, then "quality" which can be best defined as transport performance. Having arrived at the expression of maximum quality he then compares various airplanes. Using the transport quality as a unit of comparison the article analyzes the efficiency of different trains on three French railroad lines comparing them to aircraft. There is a brief reference to steamships and an abbreviated section on air transport development.

Experimental Aerodynamics

Cooling Problems with Particular Reference to the work of the 24 ft. RAE Tunnel, G. P. Douglas, M.C., D.Sc., A.F.R.Ae.S. The Journal of the Royal Aero-Nautical Society, No. 302, Vol. XL, February 1936.

The paper is divided into two parts: the first deals with the experimental equipment, while the second gives the account of tests. The contents of the paper are: Part I: the 24 ft. tunnel; tests on complete airplanes; the pulsation problem; calibration of tunnel. Part II: cooling problems; cooling drag; the theory of the duct design; entry loss; tests in the 24 ft. wind tunnel; test on the Rapier Bulldog; exit conditions; recovery of heat energy and a concluding review. The Journal includes the discussion which took place in connection with the presentation of this paper.

Propellers

Modern Problems of Propeller Adaptation (Moderni Problemi di Adottamento dei Propulsori, Cesare Cremona) L'Aerotecnica, Volume XVI, N. 3, Marzo, 1936).

The author examines the characteristics of modern supercharged aircraft engines and two-pitch propellers and proposes a method of proper design and selection to obtain the desired flight characteristics of a given airplane.

The paper treats only the problem of altitude performance, and does not include take-off limitations.

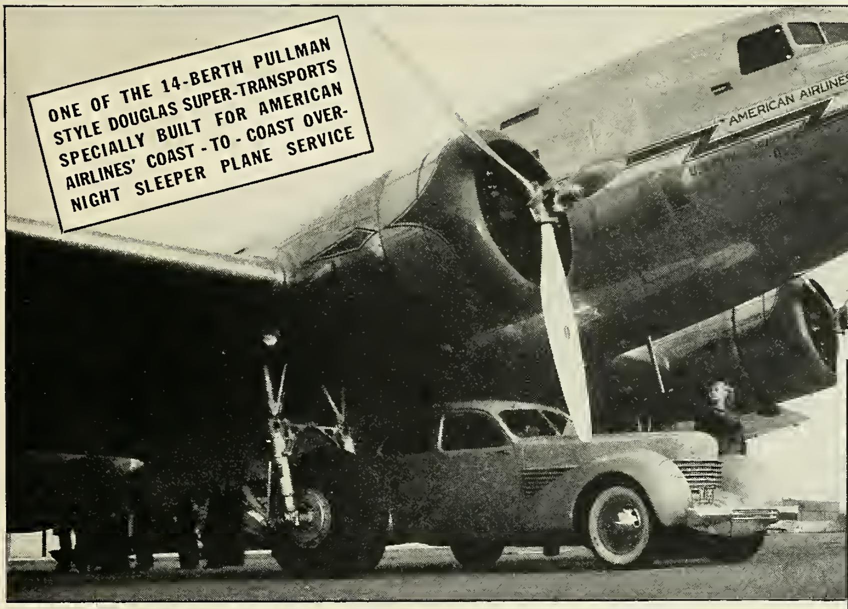
Aircraft Radio

Wireless and its Application to Commercial Aviation, Captain J. M. Furnival, M.B.E. A.F.R. Ae.S. The Journal of the Royal Aeronautical Society, Vol. XL, No. 303, March 1936.

The following introduction given in the article sets forth the topics which the author treats in this paper. "It is evident that the present-day trend is to place more and more reliance upon wireless aids for the achievements of that regularity of service in all weathers, which is looked upon as necessary for the ultimate success of truly commercial aviation.

"It seems therefore desirable to review at the present juncture the functioning of wireless communication and direction finding systems as used by the commercial air services; to consider some of the problems with which designers and operators are faced, and to bring to light the limitations and possibilities of this medium of communication and direction finding, both in respect to present and future requirements."

"AMERICAN" STEPS UP SERVICE WITH NEW GOODRICH-EQUIPT DOUGLAS "FLAGSHIPS"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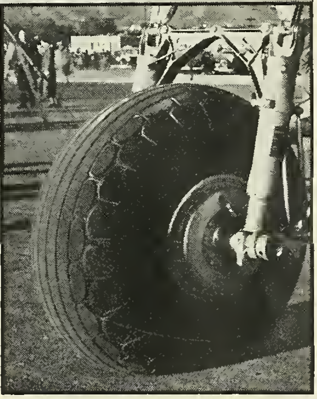
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GOODRICH ABRASION SHOES protect American Airlines' planes against destructive abrasive action of wind, rain, sleet, sand, pebbles—prolong plane life and avoid expensive repairs to tail surfaces.

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Eleventh Annual Aircraft Research Conference

●

DR. MICHAEL WATTER

● Ever increasing attendance at the annual aircraft engineering research conference at the National Advisory Committee for Aeronautics Laboratories, Langley Field, made it necessary this year to separate those participating into two groups, each spending a day at the Committee's laboratories. The first section, on May 20, included representatives of aircraft and accessory manufacturers, of air transport operating units and members of governmental air organizations. The morning was devoted to brief presentations by NACA staff members of highlights of problems which were the subject of the current year's research and investigation.

In aerodynamics, research continues on wing sections, high lift devices, effect of wing taper and relative wing position, wing fillets, fuselage shapes, surface smoothness, propellers, control and stability. The hydrodynamics division presented work on rivet head drag effect, wing tip float design, hull form and hydrofoil studies. Cowling and cooling problems included research of the NACA cowl intended to indicate the individual effect of various noses, skirts, flaps, propellers, baffles, fins, spinners and inner cowls. A new type of cowl was also developed and is being test flown at present.

Power plant research included studies of cooling problems with particular reference to fin spacing and coordination of single cylinder engine and full flight behavior. The high-speed Diesel aircraft engine of the four- and two-cycle type is being investigated with a view of improving power output, fuel consumption and reliability. A glass cylinder engine was constructed to enable study of the fuel-injection type engine cycle to supplement former research where jet studies were made in the compression chamber of the cylinder.

After this outline of the work, members of the conference visited various laboratories where more detailed presentations were made of problems researched in each department and where they were shown the equipment and apparatus.

In the afternoon, conferences were held on varied subjects to afford an interchange of ideas and to discuss specific problems touching upon subject in question. In all, there were seven conferences including, flying and handling characteristics, aerodynamic efficiency and interference, aerodynamic considerations of cowling and cooling, aircraft engine research, seaplanes and autogiros.

High-Speed Wind Tunnel

Of the new things, the latest high-speed wind tunnel was particularly impressive. If flow exploration and general behavior will prove as satisfactory as visual examination of the building and its apparent action of 250 mph, then the industry may look forward to an important addition to research. The tunnel has an 8-ft. diameter working section, and an 8000 hp electric motor drives an 18-bladed fan-propeller measuring 16 ft. in diameter. The possible speed range is from 85 to a maximum of 500 mph, thus allowing the attainment of considerably higher Reynolds Numbers than were heretofore possible. The equipment of the tunnel consists of a 6-component balance of the simultaneous and self-recording type. The working chamber is soundproofed and a special cooling system is used to maintain the circulating air at practically outside air temperature while operating at maximum speed. Particular precaution was taken to keep pieces of concrete dust from the walls falling into the airstream inasmuch as this would cause damage to the surfaces of models at the high operating speeds. The negative pressures taking place in the working chamber of the tunnel necessitate the use of pressure-controlled air locks for egress and ingress. During the conference the tunnel was run at about 250 mph.

Effect of Surface on Resistance

The committee is attacking the quantitative problem of surface effect, both as it applies to airflow in connection with influence of rivet heads on wing drag, and also its effect on water performance of hulls. A demonstration was given to show how originally laminate layer becomes turbulent at the introduction of a rivet head and a startling figure of a consequent increase of drag from that indicated by a coefficient of .001 to one of .0065. While the question of surface roughness is not new, data available is meagre and this research shows promise not only of giving better qualitative data, but of also enabling an understanding of the moot question of turbulence. The question of wing and more complete surface resistance becomes particularly important at the high speeds which must be encountered in the near future.

Towing basin work of a similar nature also gave a surprisingly high figure of improvement possible in hull take-off performance by suppression of exposed rivet heads from the submerged portion of the hull. The indicated improvement claimed is 5% at the hump speed increasing to 25% at take-off. In this connection it may be remarked that the last figure is somewhat difficult to accept and doubts arise

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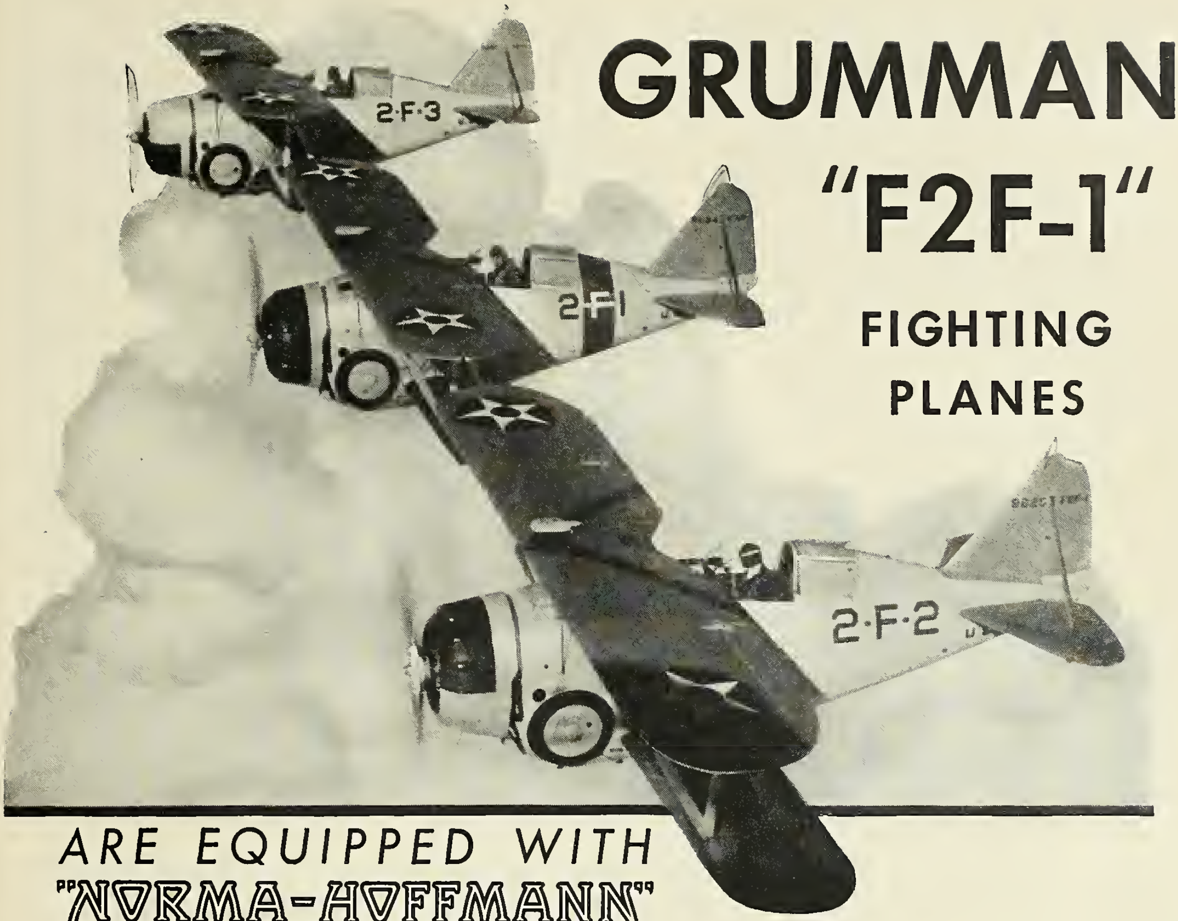
Exterior view of the new high speed wind tunnel of the NACA, Langley Field, Va.



GRUMMAN "F2F-1" FIGHTING PLANES

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PRECISION BEARINGS

These up-to-the-minute single-seaters—part of "VF" Squadron 2-B attached to the Aircraft Carrier "Lexington"—carry NORMA-HOFFMANN PRECISION Bearings: in the control surface hinges and in the surface control system; in the various instruments by Pioneer, Sperry and Kollsman; and in the Pratt and Whitney engines. These planes are the product of Grumman Aircraft Engineering Co., Farmingdale, New York—one of the many leading builders of aircraft and equipment who consistently employ NORMA-HOFFMANN PRECISION Bearings "where the bearings must not fail."

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(*Continued from preceding page*)

as to possible scale effect. This, of course, was considered by the Hydrodynamics division and they seem to feel that the gain given is reasonably correct.

Stability and Control

Although nothing definitely new was brought out in connection with stability and control, the committee has embarked on an essential program of qualitative research of stability and control behavior. It is hardly necessary to stress how loosely these important characteristics have been treated in the past and how appalling was the lack of an understandable criterion to enable a designer to have a measurable desiderata. With a clear-cut outline of data to be obtained and suitable measuring and recording equipment, test flying will leave the realm of medical diagnoses and enter the sphere of engineering precision. The data to be thus measured in connection with quantitative determination of control and stability will include period and damping of oscillations for longitudinal stability, elevator control range, speed and angular variation with speed, as well as determination of the magnitude of stick forces for different flying conditions, forces required for change of altitude, etc.

Similarly, for lateral stability and control, period of oscillation and damping are to be used as an index of normal flight stability. In stalled flight, the spinning tendency is to be the criteria. Inherently connected with this phase of behavior is roll due to side slip.

Aileron control will be defined from the power of aileron as indicated by a bank in given time, effectiveness with rudder and with deflection. Additional information on stick forces and yanking tendency and effect of trimming tabs is specified. Directional stability being inherently bound with lateral stability is not treated separately and only rudder control is considered. It is identical with the data to be obtained on the ailerons, being supplemented by the data on power with asymmetrical thrust.

Spinning

It seems that the problem of spinning is crystallizing along definite lines which although they do not offer any universal solution, have left the stage of confused complexities. The free spinning tunnel is proving important as an experimental apparatus of great qualitative value. Some of the results of comparative data obtained in this tunnel and free flight tests indicate possible reliability of result as an absolute index of behavior under actual flying conditions. However, no general cure-all can be offered, inasmuch as spinning characteristics are highly individual with design. Proper length of the fuselage (or rather proper arm of the tail surfaces) has been found to be of considerable importance. Shortening this arm resulted in rapidly increasing difficulty in recovery. The vertical tail location and area are of paramount importance. The high location of the horizontal tail is generally beneficial, the presence of low fin area is essential and decrease of blanketing effect by moving the vertical tail ahead of the horizontal tail aids ease of recovery. Once more the point was stressed that aileron control cannot be relied upon in a spin. The experimental value of the free tunnel was emphasized when by a simple and rapid addition of a small vertical area below the fuselage of a typical low-wing airplane model, poor spinning characteristics were completely eradicated. Previously a flat-spinning and non-recovering model was made to perform a slower and much more nose-down spin. Recovery upon reversal of controls was instantaneous with this change. The behavior of the typical low-wing model was compared to a private small plane of the Weick or Hammond type, and indicated safe spinning characteristics of these types. It was mentioned that in order to force this model to perform any spin at all it was found necessary to locate the center of gravity considerably further aft than actually encountered on that particular airplane.

Cowling and Cooling

Research on the NACA cowl during the past year covered what appeared to be every conceivable combination and permutation of every detail of the cowl and parts affected by it. The program apparently aimed, however, at discovering proper cooling rather than any additional aerodynamic improvement. Round nose and round opening entry were found essential for best performance in the front part of the body. In the rear the skirt must fair into the after body. Open flaps were shown to increase considerably the drag of the whole. However, there arises doubt in connection with the cooling tests by an electrically-heated unit placed in the location of the cylinder. It was not clear whether or not account was taken of the fact that the engine cylinder is not uniformly heated and requires a duplication of temperature drop along the unit to make conditions of tests comparable.

A new NACA cowl was demonstrated, but the data cannot yet be released to the public. It may be stated, however, that it offers an excellent solution to possible ring loses due to pressure baffle effect by presenting a guided air escape passage.

In connection with this research it appears that the spinner may return to use and will be used for more than the prevention of ice formation.

Hydrofoils and New Hulls

The long range, high-speed flying boat has brought to the foreground the necessity of subordinating water performance to flight efficiency. With the high wing loadings and safety demands, take-off and seaworthiness, however, cannot be sacrificed. From the tests conducted at the towing basin a renewed interest is being shown in hydrofoils or hydrovanes which were once advocated by Alexander Graham Bell in this country and the late Gen. Guidoni in Italy. In the tests conducted so far, hump resistance is reduced slightly, but later stages of get-away are improved. Since, however, hump resistance has lost its seriousness and the latter improvement is of considerable benefit to take-off, it provides a substantial saving in time and run. As an added advantage, hydrofoils seem to offer inherent shock absorbing properties which reduce the pounding of hull bottoms.

Research on hull shapes has been continued. The pointed double step type shows promise of noticeable improvement in take-off qualities, the improvement obtained with this type over representative best types in existence being about 25%. Wing tip float study has led to the conclusion of the desirability of incorporating a step in its design. The difference in behavior of two best floats (one of which has no step) is slight. The beaver tail type wing tip float must be questioned on the ground of its practicability when moored.

Highly Tapered Wings

Further verification of the stalling of tapered wings indicated that premature tip stalling can be prevented by increasing the camber toward the tip. This seems to be an interesting solution and a wind tunnel demonstration of it was offered. The two wings were provided with tuffs which allowed one to see the stalled region. One model was equipped with an ordinary tapered wing, and demonstrated a decided autorotational tendency. The model with a new airfoil change through the span had to be induced to autorotate. In connection with the degree of desirable taper it was brought out that compared on the basis of aerodynamic efficiency and weight, extreme taper is not desirable in a standard design, the 3:1 taper being the recommended practical limit.

Engines

The design of cylinder fin spacing for maximum cooling was investigated and tests established that spacing of 12 per inch for a standard fin 1¼ in. deep is the best. Smaller and larger spacings are inferior. Since the customary cylinder fin spacing is much less, it is hoped that greater power output is possible through improved cooling conditions with new fin spacing. An interesting conclusion appears to have been reached in regard to cooling, namely, that heat transfer does

(*Continued on page* 84)

AUTOGIRO

● Autogiros rise right up; sit down slowly. They do not need forward speed to get a lifting vacuum. They do need the power that creates that vacuum—but they apply it differently. As long as flying vehicles are heavier than air, dependable power will probably be their greatest need. As long as dependable power is needed, Ethyl will probably remain the favorite fuel of Aviation. Ethyl Gasoline Corporation, Chrysler Building, New York City.

The Dalton Air Navigation Computer Type E-1A

●

Lt. Comm. P. V. H. Weems, U.S.N. (Ret.)

● The Dalton Air Navigation Computer, Type E-1A is one of the latest of a long series of dead reckoning computers especially designed for the U. S. Army Air Corps by Philip Dalton, one of the country's outstanding design engineers in this line. The writer is especially interested in this development due to his association with Dalton, a Naval Reserve Officer.

The E-1A (so called from the official A.C. designation) is composed of two heavy white celluloid discs, the larger being 8" in diameter. One side is practically the same as the slide rule disc on the Mark VII Computer (described in the May, 1935 issue of AERO DIGEST) and the reverse side carries the new double-drift feature for ground speed determination. The increased diameter of the dead reckoning slide rule together with the increased thickness of the material gives greater ease and accuracy in operation.

The device is a combination circular slide rule and speed-time-distance computer, with additional scales for correcting airspeed meter indications for altitude and air temperature, and for correcting altimeter indications for atmospheric temperature. On the back is a three-color double drift diagram for finding course corrections and ground speed factors. It is intended for use by air navigators to apply the above corrections and for performing incidental computations, and has continuous scales suitable for solving any multiplication, division, or proportion. As shown on the left of figure 2, the main (outer) scales are labeled Miles and Minutes. Just inside the Minutes scale is an equivalent scale of Hours. The "60" minute and "1:00" hour marks are labeled Ground Speed Index.

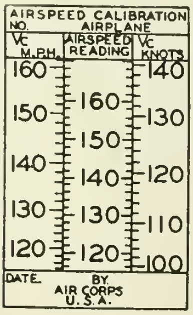
Those familiar with slide rules know that the scale figures represent multiples of 10 of the values shown thereon. The figure 10 on the Miles scale may represent 1, 10, 100, or 1,000 miles, and the figure 45 on the Minutes scale may represent 4.5, 45 or 450 minutes. In the last case if 45 represented 450 minutes, you could read directly from the adjacent Hours scale the equivalent 7 hours 30 minutes.

Example 1: Given the ground speed 140 m.p.h. and the time 48 min., find the distance. Set the ground speed index to 140 on the Miles scale and then opposite 48 on the Minutes scale read the distance 112 on the Miles scale.

Example 2: Given the ground speed 146 m.p.h. and distance 100 mi., find the time required. Answer: 41 min.

Example 3: Given the distance 30 mi. and elapsed time 15.5 min., find the ground speed. Answer: 116 m.p.h.

If the ground speed is entered in knots, the distance found is in nautical miles. If speed is entered in m.p.h., the distance will be in statute miles.



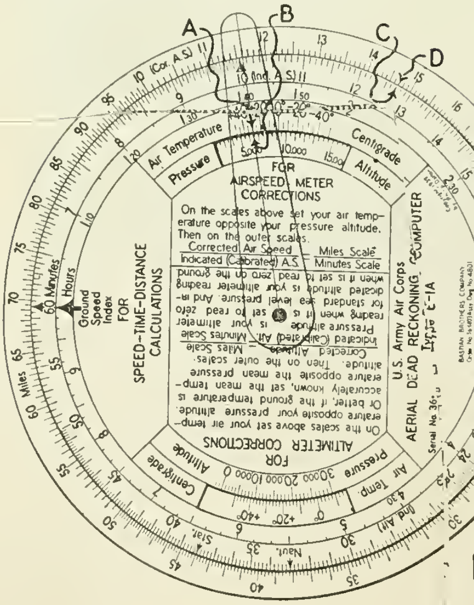
Nautical-Statute Conversion

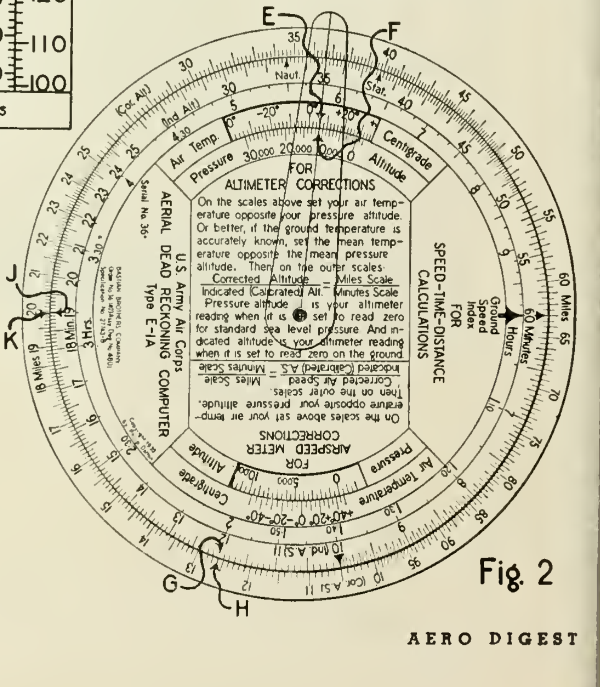
Spanning the 35 mark on the Minutes scale are a pair of indices for converting nautical miles to statute miles. Place the index marked Naut. at the number of nautical miles on the outer Miles scale and read opposite the index marked Stat. the corresponding statute miles.

Obviously, if the Naut. index be set opposite a speed given in knots, the Stat. index will be opposite the corresponding speed in m.p.h.

Air Density Corrections

To obtain true airspeed, the calibrated airspeed must be further corrected for variations from standard sea level pressure and temperature. At high altitudes and in hot weather the airspeed indicator under-reads because the air which operates it is less dense. As illustrated in figure 1, this air density correction is obtained by first setting the air temperature *A* opposite the pressure altitude *B* on the scales labeled For Airspeed Meter Corrections, and then reading the corrected airspeed *D* from the Miles scale opposite the


A
B
C
D
(Cor. A.S.)
(Ind. A.S.)
Air Temperature
Pressure
Centigrade
Altitude
FOR AIRSPEED METER CORRECTIONS
On the scales above set your air temperature opposite your pressure altitude. Then on the outer scales.
Corrected Air Speed / Indicated (Calibrated) A.S. = Miles Scale / Minutes Scale
FOR ALTIMETER CORRECTIONS
SPEED-TIME-DISTANCE CALCULATIONS
FOR
Ground Speed Index
60 Minutes
Hours
Miles
18 Miles
3 Hrs.
18 Min.
U.S. Army Air Corps
AERIAL DEAD RECKONING COMPUTER
Type E-1A
Serial No. 36
Naut.
Stat.
Fig. 1


E
F
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K
(Cor. Alt.)
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Stat.
Air Temp.
Pressure
Centigrade
Altitude
FOR ALTIMETER CORRECTIONS
On the scales above set your air temperature opposite your pressure altitude. Or better, if the ground temperature is accurately known, set the mean temperature opposite the mean pressure altitude. Then on the outer scales:
Corrected Altitude / Indicated (Calibrated) Alt. = Miles Scale / Minutes Scale
Pressure altitude is your altimeter reading when it is set to read zero for standard sea level pressure. And indicated altitude is your altimeter reading when it is set to read zero on the ground.
FOR AIRSPEED METER CORRECTIONS
SPEED-TIME-DISTANCE CALCULATIONS
FOR
Ground Speed Index
60 Minutes
Hours
Miles
18 Miles
18 Min.
3 Hrs.
U.S. Army Air Corps
AERIAL DEAD RECKONING COMPUTER
Type E-1A
Serial No. 36
Air Temperature
(Ind. A.S.)
(Cor. A.S.)
Fig. 2

calibrated airspeed *C* on Minutes scale.

In making air density corrections to obtain true airspeed use the altimeter reading with reference to standard sea level (pressure altitude). The air temperature should be read from a strut or free air thermometer.

Example 4: Given: indicated airspeed 128 m.p.h. and calibration data as shown beside figure 1. Air temperature + 30° C., and pressure altitude 6,500 ft.

To find the true airspeed: from the calibration card shown at the side of figure 1 find calibrated airspeed 127 m.p.h. equivalent to the given reading 128 m.p.h. As shown at *A* and *B* in figure 1, set air temperature + 30° C. opposite altitude 6,500 ft. Then opposite the calibrated airspeed (127 m.p.h.) at *C* on the Minutes scale read the corrected (true) airspeed 147 m.p.h. at *D* on the Miles scale.

Altimeter Corrections

The slide rule scales labeled For Altimeter Corrections, (figure 2) give air temperature corrections by two methods. The first assumes existence of the standard air temperature lapse rate of 2° per 1000 ft. of altitude. As illustrated at *E* and *F* in figure 2, set the air temperature aloft opposite the altimeter reading with reference to standard sea level, and then read the corrected altitude *H* from the outermost Miles scale opposite the indicated altitude *G* on the Minutes scale.

The second and more accurate method, which requires knowledge of the air temperature and pressure altitude at the ground level at the time the correction is made, may be accomplished as follows:

Compute the arithmetic mean temperature by the formula: $T_m = \frac{1}{2}(T_1 + T_2)$, where T_1 = air temperature at the ground level, and T_2 = air temperature aloft.

Compute the arithmetic mean pressure altitude by the formula: $P_m = \frac{1}{2}(P_1 + P_2)$ where P_1 = pressure altitude at the ground level, and P_2 = pressure altitude aloft, pressure altitude being the indicated altitude with reference to standard sea level pressure.

On the slide rule set the mean air temperature *E* opposite the mean altitude *F*, and read the corrected altitude *K* on the outermost Miles scale opposite the altimeter reading *J* on the Minutes scale.

Example 5: Given: air temperature + 6° C. and pressure altitude 11,000 ft. above standard sea level pressure; indicated altitude 12,000 ft. above ground.

To find the corrected altitude: as shown at *E* and *F* in figure 2 on the scales labeled For Altimeter Corrections set air temperature aloft + 6° C. opposite 11,000 ft., and then opposite 12,000 ft. at *G* on the Minutes scale read the corrected altitude 12,600 ft. at *H* on the outermost Miles scale.

Example 6: Given: flight-level and ground-level air temperatures —10° and + 22° C. respectively; flight-level and ground-level pressure altitudes 20,500 and 1,500 ft. respectively; indicated altitude 19,000 ft. above the ground.

To find the corrected altitude: as shown at *E* and *F* in figure 2, set the mean air temperature + 6° C., ½(— 10 + 22), opposite the mean pressure altitude 11,000 ft. ½(20,500 + 1,500); and then opposite the indicated altitude 19,000 ft. (20,500 — 1,500), applied at *J* on the scales of Minutes, read the corrected altitude 19,900 ft. from the outermost Miles scale at *K*.

Double Drift Diagram

To use the three-color double drift diagram, (figure 3), first obtain two drift measurements on headings 45° either side of the course to be made good. The diverging green lines and the green scale of the diagram represent drift measurements on the heading 45° to the right of the course, and the red lines and scale represent drift measurements on the heading 45° to the left of the course. The intersection of any green line with any red line represents the wind point for those two drift measurements. The position of this point with respect to the black lines parallel to the black course arrow, as read from the black scale at the top of the diagram, gives the course correction necessary to allow for the wind. The position of the wind point with respect to the black circles and scale along the course arrow gives the factor to be applied to true airspeed to find the ground speed.

Example 7: Given: course to be made good 60° M; drift 1° left on heading 105° M (heading 45° right of course); drift 8° right on heading 15° M (heading 45° left of course); air temperature 0° C. and pressure altitude 5,000 ft.; calibrated airspeed 150 m.p.h.

To find the heading to make good course and resultant ground speed: As shown in figure 3, mark the wind point *W* at the intersection of the green line representing drift 1° left and the red line for drift 8° right. Then read from the black scale at the top of the vertical black lines the course correction —5°, which, when applied to the course 60° M, gives the heading 55° M necessary to make good the course. From the black circles and the scale along the course arrow read the groundspeed factor 1.11.

Turn to the front of the computer and, on the scales labeled For Airspeed Meter Corrections, set the air temperature 0° C. opposite the pressure altitude 5,000 ft. to read the true airspeed 160 m.p.h. from the Miles scale opposite the calibrated airspeed 150 m.p.h. on the Minutes scale. Holding the slide rule cursor at this setting turn the index arrow at 10 on the Minutes scale to this true airspeed reading 160 m.p.h. to apply the groundspeed factor 1.11 on the Minutes scale and read off the groundspeed 178 m.p.h. from the Miles scale. Finally, set the groundspeed index to this reading for speed-time-distance computations.

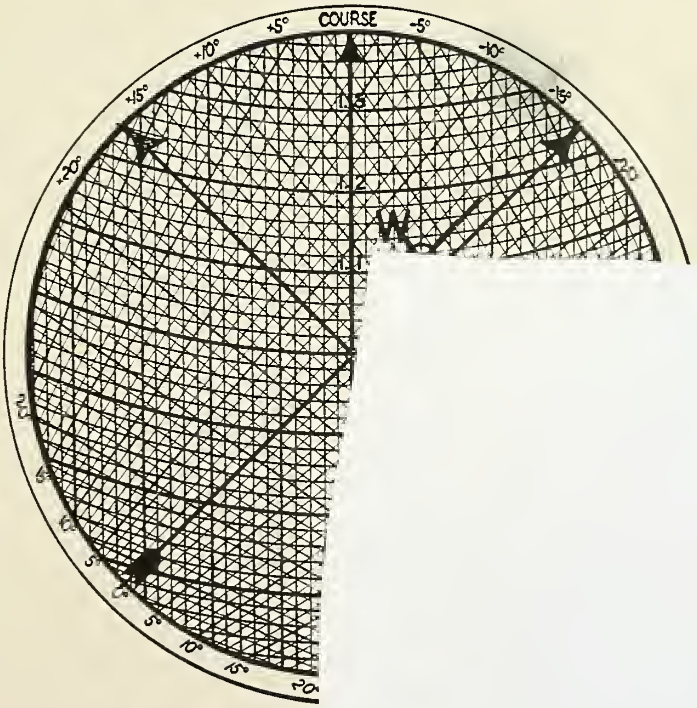


Fig. 3. The drift lines 45° to right of c
p

Russian Light Airplane AT-1

● The AT-1, designed to meet the requirements of a safe airplane competition sponsored in USSR by AviaVnito, was projected by T. N. Vinogradoff and A. A. Kriloff, professors at the Moscow Aviation Technicum and was constructed in the experimental workshops of the school.

It is a low-wing monoplane seating three in its enclosed cabin and stressed to take either a 110 or a 150 hp. engine. It is intended for the use of flying clubs, agrarian units, etc. The first model is equipped with an M-11 air-cooled engine of 110 hp. Inside the cabin measures 34" in width having a total volume (in inches) of 65 × 53 × 35 and allowing a side-by-side arrangement in the two front seats. If necessary, a stretcher can be installed and the plane used for ambulance service.

The preliminary design was given careful attention and wind tunnel tests were made to verify expected performance and ascertain proper balance and stability. Wind tunnel tests were conducted at the CAGI on a 1/14 scale model and included also tests on the effect of flaps. Stability checks were made for a center of gravity location at 27, 30 and 33% of mean aerodynamic chord while the actual airplane was balanced so that fully loaded the center of gravity is at 31.5%. With pilot alone it is at 27%.

The wing consists of two outer panels and a center section to which are attached the two units of the landing gear.

Outer panel construction is of wood, consisting of three beams and plywood covering. The two front beams are of routed "I" section while the third is of box construction. Beams are located at 20, 40 and 69.5% of the chord. Ribs are of standard truss type with the exception of the fourth, seventh and tenth which are reinforced to increase wing stiffness. Rib spacing is about 12.5 inches. The wingbow is of duralumin. Ailerons are differentially operated, and the duralumin split flaps extend over the inner half of the span. Each beam is attached to the center section by an upper and a lower hinge.

The center section is of welded tubular construction, and is permanently welded to the fuselage truss. It is made of chrome-molybdenum tubing while the fuselage truss members are of carbon steel similar to our SAE 1025 type. Fuselage covering is of light plywood and duralumin. Landing gear consists of two independent units each equipped with two shock absorbers making use of a rubber disk. Each side is completely enclosed in a fairing. The tail skid is swivelling and is also provided with a shock absorber.

The AT-1 incorporates the Watter Tunnel Cowl described for the first time in the January, 1934, issue of Aero Digest. The designers and test flying section feel that the tunnel cowl is a decided improvement and has fully justified its installation. The report states that use of this cowl resulted in noticeable smoothness of airflow, satisfactory cooling and excellent speed.

The plane was designed to take a second set of outer panels equipped with split flaps throughout the entire span. Contemplating an improved lateral control, floating ailerons were specified for his project but constructional difficulties nd satisfactory performance of the present design decided against continuance of is variation. The present installation split flaps is interesting in the detail of mpensating operating loads. This feare is obtained by the use of a device lled a compensator, which consists of trailing edge flap extending over the nter section and rotating in the inverse sense of rotation of outboard split flaps. By an appropriate differential linkage, the operating mechanisms of the two flaps are connected so that control loads are uniform and small, enabling rapid opening of the flaps. Wind tunnel tests indicated that the optimum opening of split flaps was about 45°, the coefficient of maximum lift for the whole model reaching a figure of 2 with the change of maximum *L/D* from 15 without flaps to 6.5 with flaps. The opening of flaps beyond 45° brought about not only no improvement but rather indicated a drop in maximum lift coefficient. Extensive tests were conducted on the proper shape at wing foot fillets. Their shape was found satisfactory in full flight test.

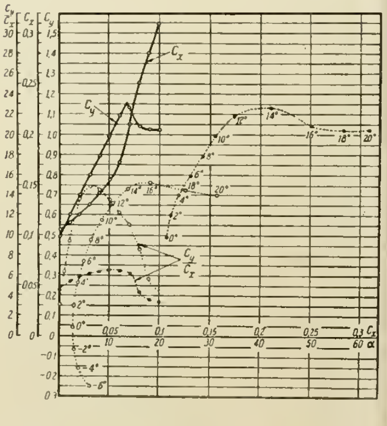
In addition to attempts to arrive at a small airplane having all desirable flying characteristics, study was given to pilot's and passenger's comfort.

There are two additional tanks in the wing roots with a total capacity of 33.5 gals. which may be used with slight overload condition.

Performance figures obtained from flight test give maximum speed 118 m.p.h., landing speed without flaps 37.5 m.p.h. and a service ceiling of 13,200 ft.

Specifications

Wing span	38.5 feet
Overall length	23 feet
Overall height	9 feet 10 inches
Wing area (total)	235 square feet
Aileron area	19.3 square feet
Horizontal tail area	35.2 square feet
Vertical tail area	16.1 square feet
Root chord	7 feet 3 inches
Tip chord	5 feet 1 inch
Root airfoil	R11C-16%
Tip airfoil	R11C-10%
Propeller diameter	7 feet 6 inches
Weight empty	1650 pounds
Useful load	710 pounds
Gross weight	2360 pounds
Wing loading	10.1 lbs./sq. ft.
Power loading	21.6 lbs./hp.



Wind tunnel polars for AT-1 airplane. Dots indicate test with the split flaps lowered

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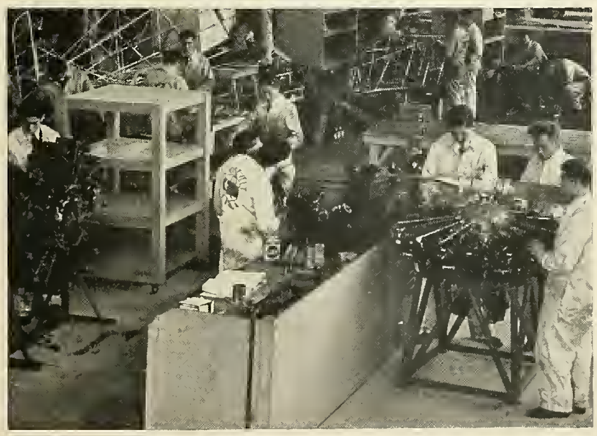

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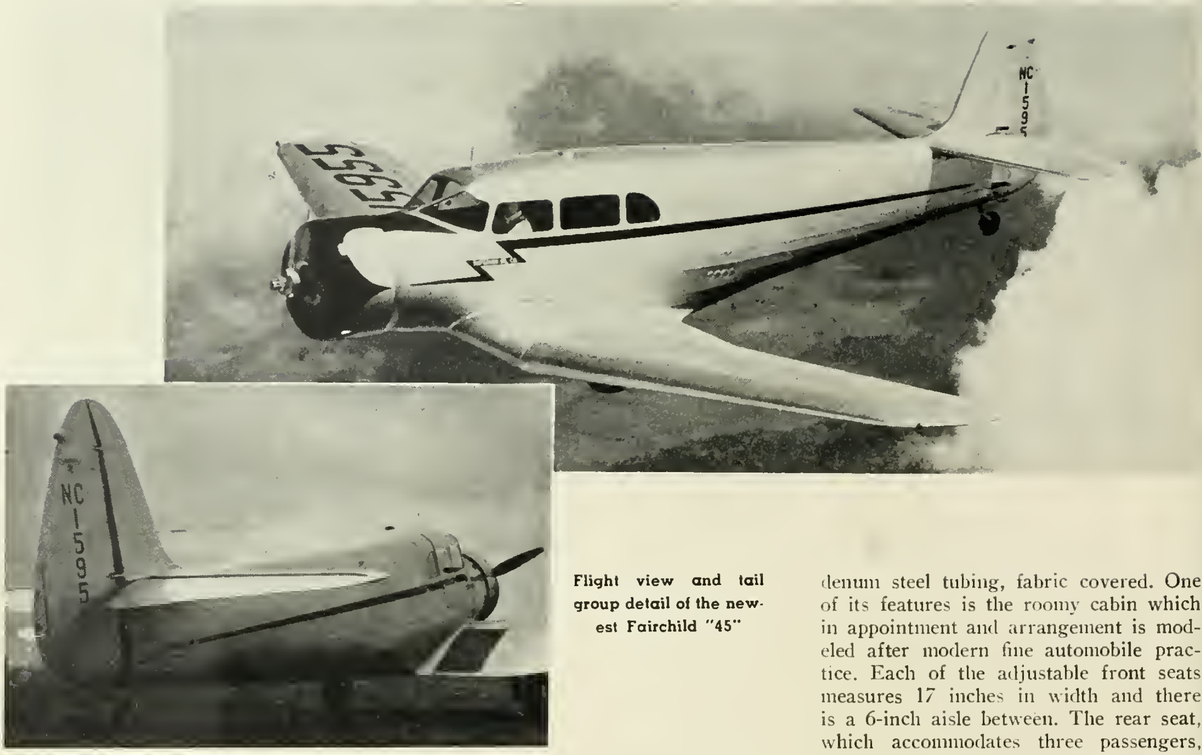
A. D. June, 1936



Flight view and tail group detail of the newest Fairchild "45"

Wright-powered Fairchild "45"

● Latest addition to the Fairchild line, the 320 hp Wright-powered "45," is a five-place monoplane designed for fast, comfortable and economical transportation. Its new combination of features are blended to provide aerodynamic efficiency. In the Fairchild "45" particular thought and study were given to the construction of an airplane which was of high performance yet assuring safety and flying ease for a private pilot of limited experience. Its stable characteristics, arrived at through coordination of wing and stabilizing surfaces design and weight distribution, are considered unusually good for a low-wing type.

Flight characteristics of the "45" indicate that it is on the positive side in lateral stability. Directionally the large fin area makes it possible to fly the plane without rudder, the fin area permitting balanced turns with wheel control only.

First of the production models was delivered to Superior Oil Co. of Houston, Texas. Besides having a total of 25 instruments and indicators, it is equipped with two radio receivers and a 50-watt transmitter, all of the latest RCA design. The second production model, now used as a sales demonstrator, is making a nation-wide tour.

The cantilever wings are tapered in plan form and thickness, the leading edges having a decided sweepback. Spars taper in length, width and thickness; they are placed at an angle to each other to secure taper in wing chord. Internal drag bracing consists of top and bottom dural compression struts and drag wires. The seven drag bays in each outer wing panel are short to secure added strength, and each of the individual compression members differs in length and thickness. Each set of four drag rods for each bay is different, as is each set of drag rod fittings.

Eighteen ribs are contained in each panel, each varying in length, thickness and wing curve, inasmuch as the section also varies from root to tip. Center-section structure is of riveted aluminum and aluminum alloy, constructed to take landing loads, to transmit loads from the outer wing panels and the fuselage, and to house fuel tanks, flaps and landing gear mechanism.

Flaps and Fuselage

Flaps are of the split balanced type, placed inboard of ailerons, one on each wing panel, and one on the center section. They are constructed of aluminum alloy tubing and metal ribs and are operated by a hand lever in the center of the cockpit near the control column. Ailerons are tapered and balanced.

Fuselage structure is of chrome molybdenum steel tubing, fabric covered. One of its features is the roomy cabin which in appointment and arrangement is modeled after modern fine automobile practice. Each of the adjustable front seats measures 17 inches in width and there is a 6-inch aisle between. The rear seat, which accommodates three passengers, measures 50 inches in width, which is more than most automobiles provide. To the rear of this seat is a 12-inch shelf where baggage and miscellaneous articles may be placed. Hot or cold air is supplied to the cabin by a valve-controlled duct on the side of the fuselage, flow capacity being governed by shutters which may be operated from the front or rear seats. Hardware and moldings harmonize and blend in design and color. Assist cords, ash trays, side windows and sound-proofing also add to convenience and comfort.

Controls and Tail Surfaces

The control column is of the throw-over type with two locking positions and is provided with an adjustment for the pilot. The instrument panel is sectional into three units, allowing separate groupings of flight, engine and radio instruments. Mounting of the board is on rubber and instruments are indirectly lighted. An adjustable trimming tab control is in the center of the cabin roof, so located as to be convenient to the occupant of either of the front seats.

Empennage structure is of the full cantilever type, the stabilizer and elevators being mounted on the top line of the fuselage. Rudder and elevators are true airfoil sections, statically and aerodynamically balanced, and provided with adjustable tabs. Construction is of riveted dural, fabric-covered.

The retractable landing gear has a 5-

(*Continued on page* 59)

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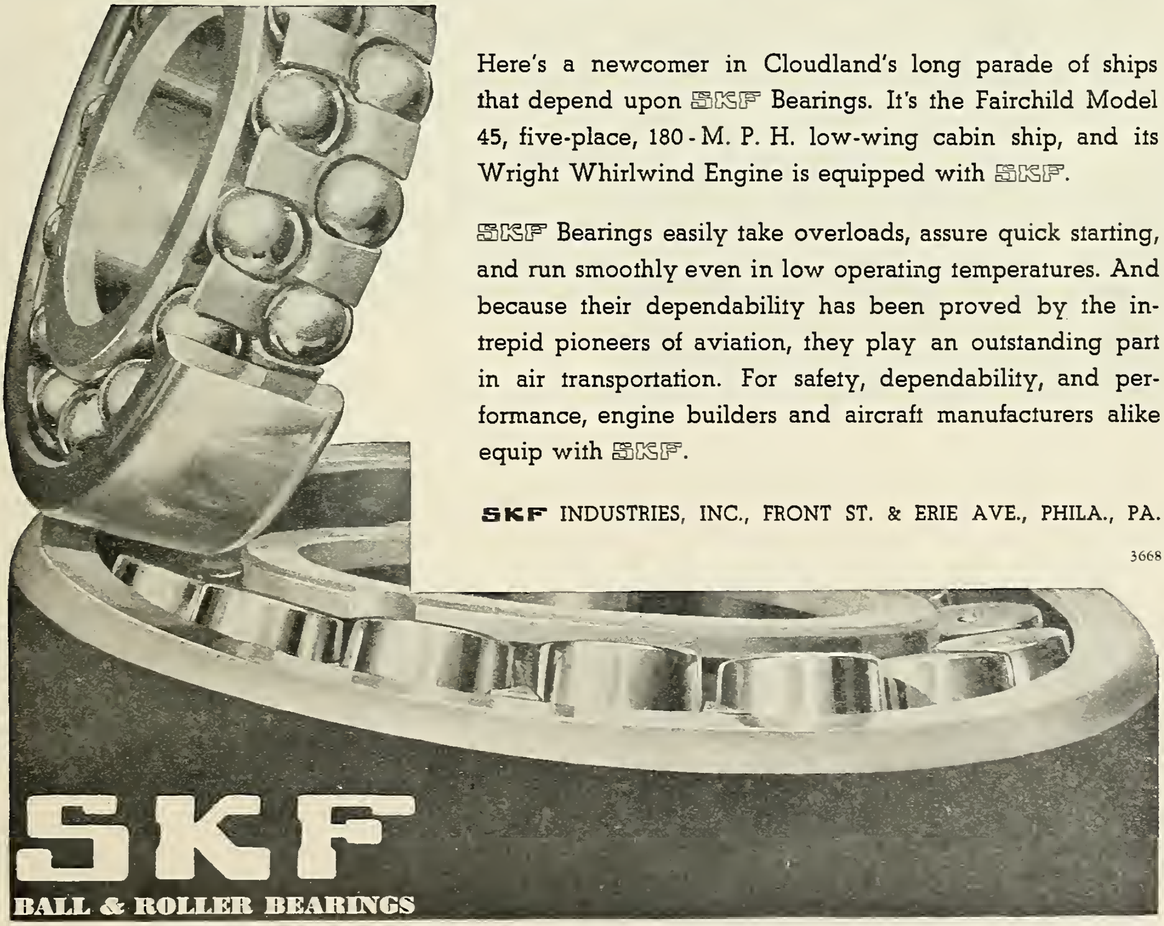

Here's a newcomer in Cloudland's long parade of ships that depend upon SKF Bearings. It's the Fairchild Model 45, five-place, 180-M. P. H. low-wing cabin ship, and its Wright Whirlwind Engine is equipped with SKF.

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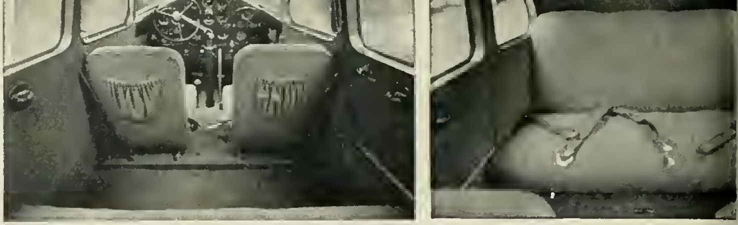

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In speed, the "45" vies with that of transcontinental airliners, yet it can be flown with ease by the amateur pilot. The commodious cabin, seating five persons, with its clear vision and luxurious appointments, gives "private car" ease. The ability to operate from the most restricted fields—yet to deliver smooth, uncrowded transportation at nearly three-miles-per minute, cruising—meets the requirements of key executives and roving sportsmen.

With a cruising range up to 7½ hours, a service ceiling of 18,000 feet, and a landing speed (with flaps) of 49 m.p.h., this sedan of the air is called the *perfect personal transport* by those whose judgment is highly regarded.

For full details see Fairchild distributor . . . or write directly to FAIRCHILD AIRCRAFT CORPORATION, Hagerstown, Maryland

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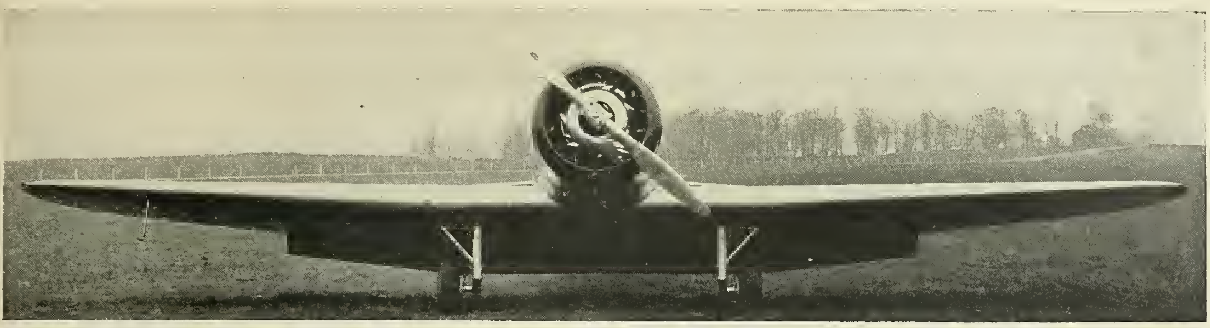
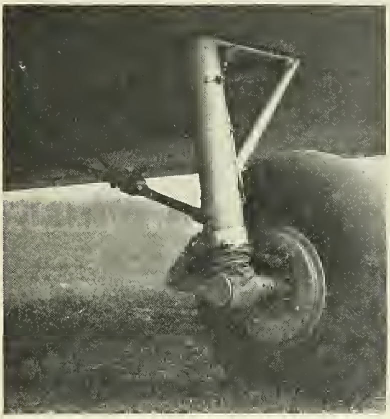


Front view of the Fairchild "45" with flaps lowered, and a detail of the landing gear

(*Continued from page* 56)

inch oleo action and moves in a true vertical plane. The retraction is light and positive. Each wheel is mounted on a single oleo spring shock leg, and each leg is braced by a folding tripod operated by a long screw attached to the rear center section spar and actuated by a crank in the cabin. The entire undercarriage is of chrome molybdenum steel with Oilite bushings. The tail wheel, of chrome molybdenum heat-treated steel, swivels through 360°, and incorporates an oil spring strut.

Specifications and performance figures of the Fairchild "45" with the 320 hp Wright Whirlwind R-760-E2 and a Hamilton Standard controllable-pitch propeller, are shown in the next column.



Specifications

Wing span	39 feet 6 inches
Length overall	30 feet 4 inches
Height overall	8 feet
Empty weight	2474 pounds
Useful load	1526 pounds
Gross weight	4000 pounds
Fuel capacity	90 gallons
Oil capacity	7 gallons
Wing loading	16.1 lbs./ft.^{2}
Power loading	12.5 lbs./h.p.
Maximum speed	180 miles per hour
Cruising speed	173 miles per hour
Landing speed (with flaps)	49 miles per hour
Service ceiling	18,000 feet
Absolute ceiling	20,000 feet
Cruising range	675-750 miles

Recent Aeronautical Patents

The following patents of interest to readers of AERO DIGEST recently were issued from the United States Patent Office and compiled by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh Street, N. W., Washington, D. C.

Method of photographic mapping. Irvine C. Gardner, Chevy-Chase, Md. (2,037,017)

Navigation instrument. Frederick L. G. Kollmorgen, Mountain Lakes, N. J. (2,037,030)

Mounting. Thomas Lord, Erie, Pa., assignor to Hugh C. Lord, Erie, Pa. (2,037,032)

Vibration insulation joint. Thomas Lord, Erie, Pa., assignor to Hugh C. Lord, Erie, Pa. (2,037,033)

Spot welding gun. James J. Paugh, Philadelphia, Pa., assignor to Edward G. Budd Manufacturing Co., Philadelphia, Pa. (2,037,040)

Gas-retaining fabrics and method of preparing. Theron P. Sager, Washington, D. C. (2,037,049)

Propeller. Martin Mansson, East Orange, N. J., assignor to Eclipse Aviation Corp. (2,037,251)

Projectile. Edgar William Brandt, Paris, France. (2,037,308)

Construction for aircraft. Albert B. Gardner, Racine, Wis. (2,037,377)

Connecting rod. Arthur H. Leak, Rumsey, N. J., assignor to the Reed Propeller Co., Inc., Garden City, N. Y. (2,037,384)

Aircraft with rotary sustaining wings. Joseph S. Pecker, Philadelphia, Pa., assignor to Autogiro Co. (2,037,433)

Actuating mechanism for airplane flotation devices. Daniel Mapes, Upper Montclair, N. J., assignor to Walter Kidde & Co., New York, N. Y. (2,037,583)

Airplane. Randolph F. Hall, Kenmore, N. Y. (2,037,626)

Helicopter. Sidney P. Vaughn, U. S. Navy (2,037,745)

Aircraft having autorotative sustaining means. Juan de la Cierva, Madrid, Spain, assignor to Autogiro Co. (2,037,766)

Airplane wing. Ralph D. Ballmann, Cincinnati, Ohio (2,038,337)

Altitude indicator for aircraft. Preston R. Bassett, Rockville Center, and Elmer A. Sperry, Jr., assignors to Sperry Gyroscope Co. (2,038,531)

Pilot director. Samuel M. Burka, Dayton, Ohio. (2,038,537)

Stop flutter device. Jean A. Roché, Dayton, Ohio. (2,038,603)

Airship. Johan W. Th. Olan, Marstrand, Sweden. (2,038,671)

Earth inductor compass. Hugh Guerra, Rome, Italy. (2,038,787)

Position-determining apparatus. Ellison S. Purington, Gloucester, Mass., assignor to John Hays Hammond, Jr. (2,038,873)

Aircraft brake. Ernest F. Goodyear, Moxhall Park, Wishaw, Joseph Wright, Stoke Park, Coventry, and Henry W. Trevaskis, Keresley, Coventry, England, assignors to Dunlop Rubber Co., Ltd., London, Eng. (2,038,898)

Automatic adjustable brake system. René Luciem Lévy, Montrouge, France, assignor to Société D'Inventions Aeronautiques et Machaniques, S.I.M. Bourt (Suisse). (2,038,944)

Gas tank discharger for airplanes. John Hays Hammond, Jr., Gloucester, Mass. (2,038,998)

Release mechanism for airplane flotation devices. Daniel Mapes, Upper Montclair, N. J., assignor to Walter Kidde & Co. (2,039,014)

Engine. Andre J. Meyer, Detroit, Mich., assignor to Continental Motors Corp., Detroit, Mich. (2,039,103)

Landing gear for airplanes. Robert S. Waugh, Alhambra, and Whiteman Reed, Huntington Park, Calif., assignors to Cleveland Pneumatic Tool Co., Cleveland, Ohio. (2,039,135)

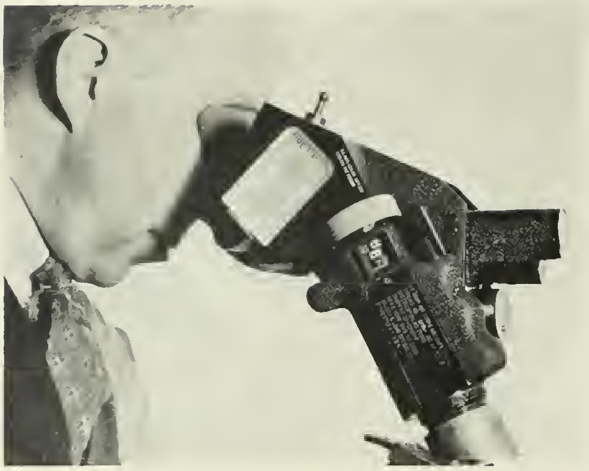
Air circulating valve in the supporting surfaces of airplanes. Franco Mazzini, Milan, Italy. (2,039,179)

Propeller manufacture. Frank W. Caldwell, West Hartford, Conn., assignor to United Aircraft Corp. (2,039,211)

Propeller device. Joseph F. Brown, New York, N. Y. (2,039,628)

Airway beacon. Frank R. House, Baldwin Harbor, N. Y., assignor to Sperry Gyroscope Co. (2,039,647)

EQUIPMENT and METHODS



Bausch & Lomb sextant

Aircraft Sextant

A new aircraft bubble sextant, with which the altitude of heavenly bodies may be measured without depending on a sea horizon has been designed in the Bausch & Lomb laboratories from plans submitted by the Bureau of Aeronautics and P. V. H. Weems, Lt. Comdr., USN, (ret.).

While primarily for aircraft application, the instrument is also useful to surface vessels during the period between evening and morning twilight when stars are visible but no horizon, or on occasions when the sun can be seen momentarily through rifts in fog, but there is no horizon from which to measure the angle.

A self-contained artificial horizon in the form of a liquid bubble supplants the sea horizon. This bubble appears in the field of the sextant as a sharply defined circle to the center of which the heavenly body is brought to coincidence. The center of the field is indicated by a circle engraved on the bubble cell. When the sextant is held level the bubble coincides with the circle.

The usual graduated arc, index bar and vernier are replaced by a worm and gear mechanism operated by a knurled thumb wheel. The scale and vernier are replaced by a counter mechanism of three graduated drums with numbers and graduations, which permit reading the altitude to a single minute of arc.

To illuminate the bubble a single standard flash-lamp dry battery, carried inside the handle, is used, the circuit passing through a two-way toggle switch. One position of the switch illuminates the altitude drums and the ground glass record slate which is divided into two columns marked "Alt" and "Time," the lines being permanently etched to allow erasure of old records.

The instrument carries two moderating glasses for reducing moon and sun glare to a comfortable degree for the eye. They are introduced or removed from the path of light by rotating a knob on the right.

The bubble cell has a free-playing bubble composed of a mixture of volatile hydrocarbons. The high thermal expansion of these liquids requires that the cell be leak-proof and that it be provided with simple and positive means for quickly altering the quantity of liquid. The instrument permits the size of the bubble to be changed by merely rotating a milled button with the directions engraved upon it.

Skilsaw Electric Drills

Two additions which help round out the line of Skilsaw ball bearing electric drills have been announced by the manufacturers.

The new 3/16 in. and 1/4 in. high production drills have been designed particularly for assembly line work where exceptionally fast drilling of holes up to 1/4 in. diameter is required. Both models are compact, light in weight and ruggedly built, construction being 7½ in. long by 3 3/16 in. diameter, with a die-cast aluminum alloy body that reduces weight, yet adds strength and durability.

A feature is the design of the handle which has been centered below the body of the tool, balanced to give the operator convenience. The handle is closer to the chuck and permits better pressure with less effort. Smoothness and reliability in operation are assured by ball bearings, placed on armature, intermediate gear and spindle. The two-pole switch is enclosed in Bakelite. Both drills are available in speeds of 2000, 2500, 3000 and 3700 r.p.m.

Instrument Landing System

United Air Lines' Communications Department has been experimenting with instrument landing systems for more than four years. Recently this work has been conducted along an entirely new line by applying the automatic pilot to the radio beam landing system. Under the supervision of J. R. Cunningham, Superintendent of Communications, and the direct handling of J. D. Woodward, communications project engineer, this experimental installation was made at the Oakland Airport and a special antenna was installed on the nose of the plane. Instead of the varying results which United obtained from the beam landing system without the automatic pilot, the new system with the robot flying the airplane functioned perfectly. Something like 250 landings have been made by human pilots "under the hood" with their hands and feet off the controls.

More work must be done before this system is placed in regular scheduled operation and it will probably be at least two years before it will be applied to commercial operations. However, the following is of interest.

United's double-track radio landing system consists of special radio beams. One, a directional beam sent out by a transmitter operating on 232 kc, is a narrow runway marker beam, 5 ft. wide at the landing circle at the middle of the Oakland airport and 10 ft. wide at the boundry of the field.

The second signal is a curved landing beam sent out from a transmitter operating on 93,000 kc. This beam follows the normal gliding path of a transport plane, and is transmitted along the runway, gradually curving upward until it is 60 ft. above the ground at the border of the field.

A special antenna is used on the nose of the plane for reception of these signals. On the instrument panel is a device which has vertical and horizontal needles, operated by electrical impulses from the directional and landing beam stations. The vertical needle registers location of the plane with respect to the runway marker beam, while the horizontal indicator records the position with respect to the curved landing beam.

The procedure followed is for the pilot to intercept the landing and runway beams at approximately 1,000 ft. at a distance 5 miles from the airport. Maneuvering the plane so that the horizontal and vertical pointers indicate the airliner is exactly on the landing and runway beams, the pilot throttles the plane down to about 80 mph and then allows the automatic pilot to control the plane. He takes his hands and feet off the controls and concentrates on the instrument with the two pointers. Occasionally he adjusts a knob on the automatic pilot control should the needles indicate a deviation from the exact landing path.

Antenna for reception of directive beam signals

Except for that the plane is controlled entirely by the robot pilot. Following the curved beam, which gradually flattens out as it approaches the runway, the plane comes down and makes a tail up landing. It is possible for the human pilot to apply full brake on as soon as the wheels touch the ground with no risk of nosing over.

While instrument landing systems are not new, the feature of United's system is the combination of the radio landing with the automatic pilot, which insures precision landings by maintaining horizontal equilibrium at all times and also by keeping the plane traveling in a straight line on the ground until a full stop is made.

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by Caldwell

● Pilot Wellington P. McFail of American Airlines was awarded the Air Mail Flyers Medal of Honor by the President of the United States for an "extraordinary achievement," as Postmaster General James ("Jams" to me) Farley describes it in the citation. I agree that it was an extraordinary achievement. And this being the first time that Jim Farley and I have ever agreed about anything, it makes it twice as extraordinary.

Pilot McFail had taken off from Texarkana one fine afternoon in December, 1933, with a load of mail and no passengers, bound for Dallas. He was flying a new low-wing single-engined monoplane with a retractable landing gear. We'll not identify it by name, as airplane manufacturers are very sensitive souls and start shuddering whenever they read about some accident that has overtaken their product. What's more, they get so worked up that they sit down and write me letters complaining about my lack of tact if I mention that anything ever happened to one of their airplanes. If it breaks a record, they don't mind if I mention it; but if it sheds its engine I'm to keep the matter a secret. So this was an airplane of unknown make with an engine by an unknown manufacturer and a propeller built by another chap who didn't even know the two other fellows. I hope I'm sufficiently vague this time, Mr. Hartson.

So here was McFail flying serenely along at about 200 miles an hour, the motor running smoothly, and everything going to the satisfaction of the pilot, who made his routine radio report 40 minutes after taking off and again settled back to enjoy himself. He was at an altitude of 5,900 feet and was just thinking how pleasantly monotonous it was sailing along like that, when he noticed a slight vibration. It was followed almost instantly by a rending crash and jar, and the ship zoomed up like a startled gazelle that has been frightened by Senator Black, who I believe fitted himself for his present job of Chief of the Senate Inquisition by scaring little children when he was a lad.

Wellington McFail

The ship zoomed so suddenly that McFail was thrown to his knees on the floor of the cockpit, with his head slammed up against the instrument panel. It was the first time Mac had been in an attitude of prayer since he was a child, but if he had been able to look around at that second he would have discovered that he really had something to pray about. His hand, jerked from the controls, automatically groped around and cut off the gasoline—he was still plastered against the front of the cockpit with his head between his knees.

Released from the momentum of the sudden climb, he lifted his head and glanced at the altimeter. It said 6,500 feet, and the ship indicated that it had reached the top of its climb and was falling off to the right—it went into a stalled half turn with tail down and right wing pointing down, a positively indecent position for a respectable mail plane, even though considered a normal attitude for a plane with Dick Blythe at the controls. McFail grabbed the stick and felt some pressure on the controls, noting at the same time that he was short an engine complete with all attachments. All that stood between him and his immediate future was the firewall and instrument panel. He righted the ship into a dive and reached to unbuckle his safety belt. Then, realizing that he had enough height to give him plenty of time to jump, he experimented with the controls. In the steep dive the ship hunted up and down roughly. He pulled back on the stick and slowed down the glide. The ship rode a little easier. Then he recalled that a German glider with which he had been experimenting had performed the same way, hunting in a steep glide but sailing smoothly in a slight glide. So he lessened the angle of descent, and the ship behaved very well. Then he picked out a field which once had been used as an emergency field. He headed for it. He didn't dare put down his retractable landing gear for fear of disturbing the balance of the machine. At 200 feet it suddenly occurred to him that perhaps it would have been safer to jump and tell the insurance company they owned the remnants of an airplane. But it was too late to change his mind then. So without an engine and without a landing gear he brought the ship down, skiing along on the underside of the fuselage and coming to a stop with no further damage to plane or contents.

With the assistance of nearby residents the engine was located four miles away. One blade of the prop had broken off and the out of balance forces had torn the engine from the plane. A new one was later installed and the ship was put back in service, none the worse for its brief career as a glider. The insurance company should have sent Mac a check. But you know what those insurance companies are; you have to shuffle off to beat them.

McFail was born 43 years ago in Minneapolis. In April, 1917, he enlisted with the 13th Engineers, was sent to France and served there for the duration of the war with the French Second Army. In 1923 he decided that he wanted to get into aviation in the worst way, so he started as a wing-walker with Byron Good and M. M. Merrill, who were ardently advancing the art of aviation by barnstorming through Texas. In six months of clambering over the wings of Jennys and hanging by his knees on the undercarriage McFail developed a grip so powerful that it would have taken an explosion to jar him loose from the plane. One of his stunts was to stand on the top wing with his feet in loops while the pilot looped the ship for the entertainment of the assembled yokels. He was standing on top one day at Wilson, Oklahoma. Merrill was flying the ship at a low altitude and had just dived to get up speed and was pulling up into the loop when the engine quit cold. As McFail scrambled down into the cockpit again it occurred to him that if the engine had quit when that Jenny was just coming up to the top of the loop that he would have been in a bit of a predicament. He decided right there that seats were in airplanes for people to sit on and that sidewalks, not wings, were built for pedestrianism.

Air Mail Medal of Honor

He learned to fly with Byron Good, who gave him a trifle less than an hour and a half of dual and then sent him solo. He barnstormed for five years and started working May 1, 1928, on the Minneapolis-Fargo passenger run for the Mid-Plane Sales and Transit Co., later Universal Airlines.

(*Continued on page 84*)

Eighty-four of these SBU-1 Scout-Bombers have gone into service with the U. S. Fleet during the past few months. Outstanding in performance and tactical effectiveness, they are already adding new lustre to this famous name—

CHANCE VOUGHT AIRCRAFT
East Hartford, Connecticut
DIVISION OF UNITED AIRCRAFT
MANUFACTURING CORPORATION

Vought Corsair

DIGEST OF THE NEWS

AIRPORTS

WPA Allotments

Improvement of the Grand Island, Neb., municipal airport has gotten underway as a WPA project and is to be completed by September 1 this year. Improvements will include a modernistic administration building, new hangar, individual water and sewage disposal facilities, asphalt service apron 200 ft. × 900 ft. and asphalt runways 150 × 4000 feet.

* * *

The municipal airport at North Platte, Neb., is to receive a $580,200 WPA allotment for improvements this year. Improvements will include construction of concrete runways the length of the field, an administration building, additional hangars and an extension of the lighting equipment.

* * *

Tulsa's $63,000 improvement project at the Tulsa Municipal airport, to be financed by WPA funds, got under way recently when engineers completed preliminary surveys for more than a mile of additional hard-surfaced runways. According to Charles Short, Jr., airport manager, in addition to a new drainage plan for the airport parking space, the north-south runway will be extended to 3,000 ft. An additional runway extending NE-SW will be constructed and will be 3,500 ft. long. All runways will be hard-paved with asphalt and will be 100 ft. wide.

New Ports

The new $600,000 airport under construction near Johnson City, Tenn., will be named McKellar Field, in honor of Senator Kenneth D. McKellar, of Memphis. The field is expected to be completed Nov. 1 and will serve the cities of Kingsport, Johnson City and Bristol.

* * *

Purchase and improvement of Alexander Field, across the Arkansas River in Oklahoma, from Fort Smith, Arkansas, and its conversion to a municipal airport is contemplated by the Fort Smith city commission.

* * *

The La Crosse (Wisc.) county board of supervisors has voted to purchase French Island airport which it has controlled under lease for the past three years. The county will also develop the airport for an approval of the Bureau of Air Commerce.

* * *

The city council of Lufkin, Texas, held a special session in which it voted to buy 120 acres of land west of the city for an airport site.

Improvements

The city council of New Philadelphia, Ohio, has decided to build a 15-plane hangar at the Schoenbrunn municipal airport.

* * *

The municipal airport of Tyler, Texas, is being improved, including grading and graveling of the SE-NW runway and placing of terracing and drainage structures at several locations over the field.

* * *

Citizens of San Diego have authorized an exchange of property with the United States Government whereby San Diego will gain an additional 60 acres to its municipal airport. This area includes the section which now lies between the present northerly limits of Lindbergh Field and the southerly limits of the Marine Base. This area will be filled in through harbor dredging operations to give Lindbergh Field additional land for the extension of runways and the allocation of future aircraft factory sites.

Personnel Notes

Ralph Page was appointed superintendent of the Lambert-St. Louis Airport succeeding Milton D. Girton.

* * *

Leslie M. Marsden succeeded Allan Gardiner as president of the Buffalo Aeronautical Corp.

* * *

Wright Vermilya, Jr., severed his active association with the Vermilya-Huffman Co., to organize a new company. Known as Vermilya Aviation Sales, Vermilya's new company essentially will do sales promotion for factories. Vermilya also resigned as secretary of the Lunken Airport Co. He remains, however, a stockholder and director of the concern. Tentative plans, he said, include the opening of a downtown office. His base of operations will be at Hugh Watson Field.

New Companies

Bennett Aircraft, Inc., Love Field, Dallas, has been granted a Texas charter. Incorporators are Frank W. Bennett, R. C. Rochelle and Frank Merrill.

* * *

The Modern Hangar Corp., has been formed in Cleveland, Ohio by E. F. Bach, S. L. Murphy and William F. Back.

* * *

Aviation Insurance Sales, Inc., has been formed in Cleveland, Ohio. Incorporators are R. L. Bailey, L. I. Kinestiver, and C. Morgenstern. 500 shares of no par stock have been issued.

* * *

A general aviation and aircraft business will be conducted by Spokane Air Transport Corp., Inc., which was formed at the Spokane Airport recently. With nominal capitalization, the enterprise was incorporated by L. F. Overman, K. Sand and J. L. Seawall.

* * *

Wenatchee Air Service, Inc., was recently formed and incorporated at East Wenatchee, Wash., with capitalization of $5000. The company will deal in aircraft equipment, products, supplies and accessories. Incorporators are C. J. Christenson, K. D. Paton and R. J. Parkhill.

Members of the press, having covered the "Hindenburg" arrival, leave Lakehurst for Newark

* * *

Milwaukee Airways, Inc., a new organization headed by Merle Zuelke, has taken a two-year lease on the Curtiss-Wright airport and hangars just north of Milwaukee. The firm succeeds Associated Aviation Corp. whose lease expired. John Chapin has been named field manager. The new operators plan to improve the field and conduct an airplane charter service, passenger hopping, and sales and service.

* * *

McCauley Aviation Corp. was formed at Dayton, Ohio, with a capital of $200,000 and 400 shares of no par stock. Incorporators are Ernest G. McCauley, Maurice Pate and Joseph W. Sharts.

Airport Activity

Edward Becker has leased the field and equipment of Becker Flying Service, to Charles M. Cox, who will operate the flying service this year.

* * *

Phil's Flying Service, operated for the past several years by Phil Miraglia at Buffalo Airport, moved May 1 to the Consolidated flying field at Tonawanda.

* * *

Charles Kidder, shop and field superintendent for Aircraft Industries, is completing arrangements to move the engine overhaul shop to the hangar formerly occupied by Airplane Development Corp., at Glendale, Calif. The new shop will be double the size of the present shop and will contain more complete equipment. The size of the stock room will also be extensively enlarged.

AIRLINES

Traffic

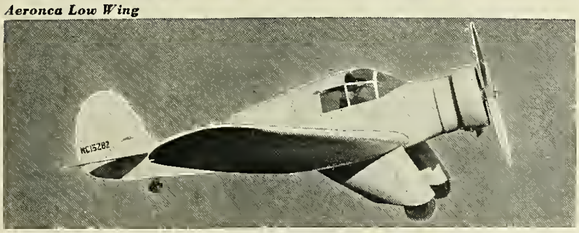
Nineteen of the 20 scheduled airlines operating in the United States in March, 1936, carried about 15,000 more passengers than in the same month of last year, while 18 of the companies carried approximately 300,000 more pounds of express, according to the Bureau of Air Commerce. These increases were achieved by flying only 708,708 more miles than in March, 1935. Figures from one company had not been submitted at the time the reports were placed in composite form, and one company omitted express poundage.

In March of this year, 70,123 passengers and 535,541 pounds of

(*Continued on following page*)

AERONCA sets Air Records and SALES RECORDS TOO

Aeronca Low Wing

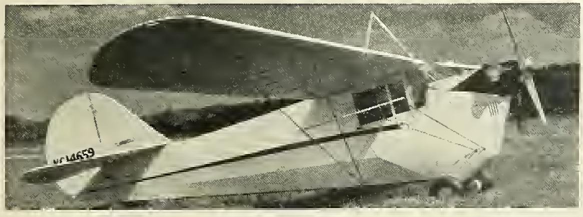


Six new air records in the light plane categories were set in one month this spring by American aviators. *All six* were made in Aeroncas!

And now sales records are being set by Aeronca distributors—sales records that prove the overwhelming acceptance of Aeronca leadership. Aeronca gives more for your airplane dollar. Details upon request.

AERONCA
AERONAUTICAL CORPORATION OF AMERICA
Lunken Airport, Cincinnati, Ohio

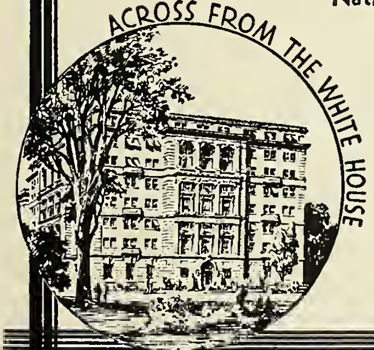
Aeronca C-3



In Washington

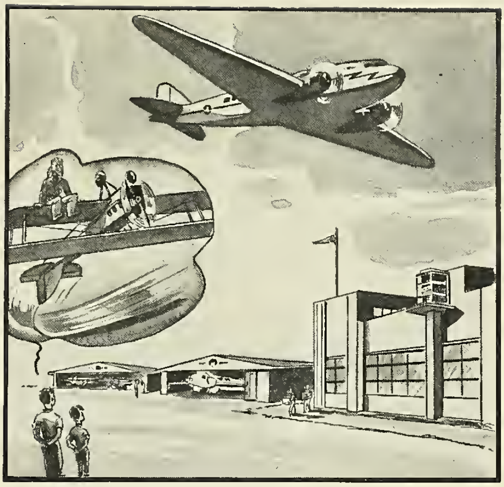
The best in accommodations, location and smart surroundings are available at this distinctive hotel. Write or wire for reservations.

Nathan Sinrod
Manager


ACROSS FROM THE WHITE HOUSE

The HAY·ADAMS HOUSE

LAFAYETTE PARK AT SIXTEENTH • WASHINGTON, D.C.



"MEBBE IT IS SAFER, BUT THE BARNSTORMIN' DAYS WAS MORE EXCITIN!"

Few people are interested in figures, yet figures tell aviation's most dramatic story . . . the story of modern flight made swift and sure by efficient overhaul and top-flight maintenance.

Many aviation concerns have simplified their maintenance problems with the help of Sherwin-Williams engineers. American Airlines, for one, has adopted 100 per cent the Property Maintenance Paints and Painting Service of the largest paint company—Sherwin-Williams S-W paints cover the hangars, buildings, terminals, and other structures of American Airlines in 57 cities. Good paint protects A-A's equipment and makes for more efficient shop work.

The services of S-W engineers are available without cost on all problems of painting and finishing, hangar and shop maintenance. Write to The Sherwin-Williams Co., Cleveland, Ohio.

SHERWIN-WILLIAMS PAINTS

AEROPLANE FINISHES

SEE THE SHERWIN-WILLIAMS FINISHING ENGINEER

(Continued from preceding page)

express were carried, and 4,834,699 miles, 31,615,386 passenger miles and 280,688,857 express pound miles flown by the companies making reports.

* * *

Air Express Division of Railway Express Agency showed an increase of more than 68% for March 1936, over March 1935, in the total amount of air express business handled over its contract airlines.

While many rail-air shipments are included in the above, all of the returns for co-ordinated rail-air business from the 23,000 off-air line offices are not included.

* * *

United Air Lines registered a gain of 17% in revenue passenger-miles, 61% in express and 10% in air mail the first quarter of 1936 over the same period last year, and completed 95.5% of 3,341,243 scheduled miles.

United's planes on the New York-Chicago-Pacific coast and Seattle-San Diego routes carried 33,470 revenue passengers a total of 15,795,837 passenger-miles, as against 29,161 passengers and 13,450,927 passenger-miles in the corresponding 1935 quarter. Express amounted to 476,202 lbs. contrasted with a 1935 quarterly total of 295,247 lbs. Air mail totaled 1,251,661 lbs. against 1,133,917 lbs., a gain of 10%.

* * *

Outgoing St. Louis, Mo. air mail increased 35%, and inbound air mail 45% in March this year, as compared with 1935, it was announced by Postmaster Rufus Jackson, who also said air mail of local origin in March increased 19% over February.

* * *

Passenger traffic out of Memphis, Tenn., on Chicago and Southern Air Lines', Chicago-New Orleans route, increased 75% during the first quarter of this year, according to Tom Lemly, Jr., Memphis district manager. Air mail increased 240%, he said.

For the first quarter of 1936 the company shows 115% increase in passenger business as compared with the same period in 1935. The greatest gain of any city on the line was Chicago with a 384% increase.

Lockheed Electras are now being operated between Chicago and St. Louis and this service was extended over the entire system on May 1.

* * *

Passengers and express transported by Pennsylvania Airlines on the Washington-Milwaukee route and mail carried on the Detroit-Milwaukee division of the line during March exceeded February business by substantial percentages, it was announced by W. J. Austin, vice-president.

The most outstanding rise was recorded by air express which increased 581% over February and 898% over March of last year.

4332 passengers were carried, putting the total number of passengers transported by the line in its almost 9 years of service beyond the 99,000 mark. Express poundage totalled 31,929.

Personnel Changes

Appointment of Mrs. Charles W. Holman as head of a special woman's passenger division of Northwest Airlines, Inc., was announced by Croil Hunter, vice-president and general manager. Mrs. Holman's division will specialize on an educational program to interest women in air travel.

* * *

H. W. Stephens, traffic representative for Eastern Airlines at Nashville, Tenn., for the last four months has been transferred to Chicago. His place was taken by R. A. Daniel.

* * *

W. R. Beattie is now traffic manager for Delta Air Lines in Dallas and has his offices in the lobby of the Baker Hotel. Beattie succeeds Fred Ball who returned to co-piloting duties on the line.

* * *

Capt. Robert S. Fogg was recently named Boston district manager for Marine Airlines, Inc., which plans an amphibian run between Boston and New York.

* * *

Transcontinental & Western Air, Inc., announced the appointment of Frederick G. Betts as purchasing agent at Municipal Airport, Kansas City, Mo.

* * *

Thomas Wolfe, former secretary for the Chicago Aero Commission and more recently district traffic manager in that city for United Air Lines, has been appointed general traffic manager for Western Air Express, now operating the Salt Lake City-Los Angeles-San Diego passenger-mail-express route. Wolfe succeeds George Cussen, who resigned.

* * *

Cecil du Rose, traffic manager at Spokane, Wash., for Northwest Airlines, Inc., has been promoted to the operations department for the western division. In his new capacity he will work under Fred Whitemore, vice-president in charge of operations. Ray Roos has succeeded to du Rose's position.

* * *

T. Park Hay, Director of Public Relations for Transcontinental & Western Air, Inc., has resigned to enter other fields of public relations and sales promotion. The resignation became effective June 1.

* * *

Rembert Thigpen, formerly with United Air Lines in San Francisco, has been transferred to the company's Portland office, where he will have supervision of southern Oregon operations.

* * *

C. G. Peterson was appointed Superintendent of Organization of Railway Express Agency. Peterson will devote his attention to development of new ideas, new services and the coordination of these with activities of the company.

* * *

A. M. Shaver has been advanced from the position of chief passenger agent for United Air Lines at Cleveland to assistant chief passenger agent of the entire system with headquarters at Chicago. Another change was involved in the appointment of Gerard B. Lambert, Jr., as Hollywood traffic manager.

* * *

Miss Ruth Kathryn Rhodes has been appointed chief air hostess for Transcontinental & Western Air, Inc.

Removal

Columbia Airlines, Inc., moved its western terminal and maintenance base from Curtiss Airport, East St. Louis, Ill., to Lambert-St. Louis Airport, Robertson, Mo. The company operates a feeder system between East St. Louis and Louisville, Ky., where it connects with an Eastern Airlines plane for Atlanta, Ga., Jacksonville and Miami, Fla.

* * *

In a consolidation of its eastern and southern division, American Airways has begun removal of most of its forces from Fort Worth, Tex., to Chicago, Los Angeles and Newark, N. J., leaving Dallas, Texas, as its air center of the southwest.

Engine overhaul stops will be concentrated at Chicago and maintenance of planes will be done at Los Angeles and Newark.

Schedule Revisions

Non-stop service between Chicago and New York was inaugurated May 1 by TWA, Inc., which is offering 5 flights each way on a 3 hour 45 minute schedule.

* * *

United Air Lines in May increased its scheduled flying to more than 1,500,000 miles a month when it added new flights on its New York-Chicago-California and Seattle-San Diego airways amounting to 150,000 additional miles monthly. This mileage equaled that flown during peak months last summer. On June 1 the company added an eleventh daily round-trip flight between New York, Cleveland and Chicago, with possible increases of schedules on other routes.

* * *

Inauguration of non-stop Buffalo-to-Boston service, utilizing the new Douglas airplanes, was announced by C. R. Smith, president of American Airlines.

The new Buffalo service, Mr. Smith said, will have Chicago as a western terminal and will be non-stop from Chicago to Buffalo to Boston.

DST Flight

Establishing a non-stop record for stock commercial airplanes, the first of the American Airlines Douglas DST's flew non-stop from Los Angeles to Fort Worth, in 6 hours 49 minutes, at an average speed of 186 mph. With a full capacity of 820 gallons, the plane used less than 600 gallons in making the flight. Equipped with 1000 hp Wright Cyclones, the test flight was made at a conservative power output of 550 hp per engine.

The first of the new Douglas planes goes into non-stop service between Chicago and New York about June 1.

Summer Service

A summer airline to Cape Cod, Martha's Vineyard and Nantucket, Massachusetts, offering commuter service into Boston, is now in operation. The new line, Mayflower Airlines, Inc., uses four tri-motored Stinsons.

Two round trips a day are provided, planes departing from each terminal at 8:00 am, and 5:30 pm with fares only slightly over regular railroad and boat fare. Parker Gray is operations manager.

AIR SERVICES

Dirigible Training

The Navy Department announced that Lieut. (jg) Richard N. Antrim and Lieut. (jg) Richard S. Andrews, have been selected for training in lighter-than-air-craft at the Naval Air Station, Lakehurst, N. J. The course of instruction will begin July 1 and will be of one year's duration. It will include training in the non-rigid airships at that station and in the U.S.S. *Los Angeles* in a non-flying capacity.

Seven officers now at Lakehurst have been receiving training since July 1, 1934. Several of them will be detached this summer, while others will remain as students.

(Continued on following page)

MAKE SUMMER SUNSHINE PAY QUICK DIVIDENDS *Equip* WITH EDO'S!

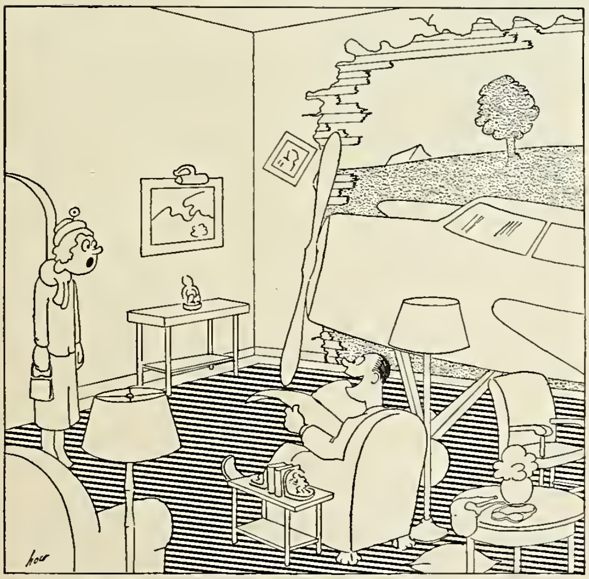
FOR LUCRATIVE "HOPS" AT LAKE RESORTS

FOR INSTRUCTION AND STUDENT CHARTER

FOR COMMUTING TO CITY CENTERS

Go wherever you wish this summer—to the mountains, to the North Woods, to the seashore—and you'll find real gold awaiting you at the rainbow's end, if you fly on Edo Floats. For you can land and take-off wherever there is water . . . and in Vacation-Land, this means practically everywhere. Money-spending people will clamor for short rides. You will sell many hours of student instruction. There will be hunters and fishermen to charter your plane for trips to otherwise inaccessible points. Business men will be glad to utilize the convenient commuting service you offer to town . . . since "doorstep" facilities for seaplanes are now available in many cities. Find out how easily and quickly you can prepare for summer business with EDO Floats, interchangeable with wheel landing gear, by writing to EDO Aircraft Corp., 610 Second St., College Point, Long Island, N. Y.

EDO FLOATS



"She looks so swell with that new Glidair Dope finish that I couldn't leave her in the hangar."

The Glidden Company offers to the aircraft industry a new line of Pigmented Nitrate Dopes. HIGHER LUSTRE—CLEANER COLORS—INCREASED FLEXIBILITY—EASIER POLISHING—EXCELLENT WEATHERING QUALITIES—*Write for free booklet.*

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National Headquarters, Cleveland, Ohio

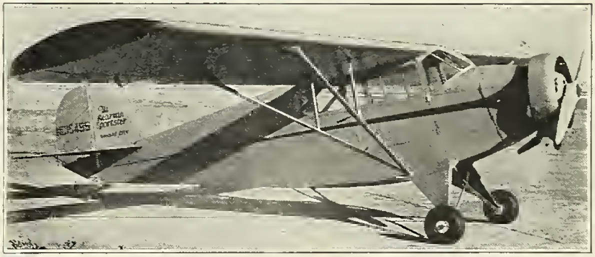
GLIDDEN

PAINTS · VARNISHES · LACQUERS · ENAMELS

EVERYWHERE ON EVERYTHING

Plants and Warehouses in all Principal Cities

Edo Pontoons now available with famous REARWIN *"Sportster"*



REARWIN "Sportster" Model 7000 A.T.C. 574 and Model 8500 A.T.C. 591

● Widespread approval comes from the coast and lake regions for this added feature of the Rearwin Sportster—the addition of pontoons for flying where water landings prevail. Another step forward is the choice offered of three motors for varied power requirements—LeBlond 70 H.P., LeBlond 85 H.P., and the Warner 90 H.P. The Rearwin Sportster's popularity for private flying, business use, and student training has steadily increased as no other plane in its price class offers all its features—including 70-inch hydraulic landing gear; 24 gallon fuel tanks in wings; full 50-lb. luggage capacity including 24-inch Gladstone bag. Ample head, shoulder and leg room is provided by the commodious cabin, lined and beautifully upholstered.

Compare the Rearwin with full specifications and performance of other airplanes selling around $2,000—comparison shows why the Rearwin is fastest selling plane at home and abroad in anywhere near its price class. Your wire or letter brings complete details.

"Rearwin Popularity is proof of Rearwin Superiority."

REARWIN AIRPLANES

Ninth Successful Year

FAIRFAX AIRPORT KANSAS CITY, KANS., U.S.A.

(Continued from preceding page)

New Appointments

Fifty Second Lieutenants will be appointed in the Regular Army Air Corps as the result of examinations to be held under authority of an Act of Congress approved August 30, 1935. The preliminary examination is to be completed not later than July 1 at Mitchel Field, L. I., and other Army Air Corps posts throughout the United States. Part One of the final examination will begin July 27 and Part Two on July 30.

Appointments will be limited to graduates of the Army Air Corps Training Center and to flying cadets who will be graduated June 30, 1936.

Trophy

Acting Secretary of the Navy, Admiral William H. Standley, announced that a new trophy designated as the Rear Admiral William A. Moffett Memorial Trophy will be awarded annually to the battleship- or cruiser-based aviation unit which conducts its operations throughout the year with the maximum of safety.

The trophy, a large silver plaque mounted on a walnut base, has been purchased with funds received from Naval aviators and is in memory of the late Rear Admiral William A. Moffett. The plaque bears 25 individual shields upon which will be engraved the name of the unit which annually receives the award. The ship upon which the aviation unit winning the trophy is based, will retain the trophy until such time as it is won by another unit.

Award of the trophy will be made under the same rules that apply to the award of the Schiff Memorial Trophy, which is presented annually to the naval aviation activity flying the greatest number of hours during the fiscal year with proportionately the fewest injuries to personnel and least damage to material. The Moffett Trophy, however, is to be competed for only by battleship and cruiser based aviation units which, due to the nature of their services, have particular problems to meet and so are deserving of this special recognition.

Improvements

Development is now underway at Los Angeles Harbor on a 225-acre land and seaplane base for the U. S. Navy. The 112-plane observation wing attached to the battleship and cruiser division of the Fleet Battle Force, permanently based at Los Angeles Harbor, will make its home at this land base, which will also be available for use of land planes attached to the carriers, *Saratoga*, *Lexington* and *Ranger*.

This port, officially designated as Reeves Field, and located on Terminal Island in the heart of the Fleet anchorage area, is the object of a development program under plans drawn by the City and Navy Department engineers and will be carried out under the direction of the Los Angeles Harbor Department.

Re-equipment

Eight new observation planes equipped with P & W twin row 14-cylinder, 700 horsepower engines, instruments for blind flying and with radio are scheduled to be delivered to the Maryland National Guard within the next few months, according to Col. William D. Tipton of the Twenty-ninth Division. The new ships, Douglas O-43's will replace a similar number of Douglas O-38 planes.

Trainers

After performance tests at Wright Field, Dayton, the Air Corps accepted the first six of its new BT-8 planes, manufactured by Seversky Aircraft Corp. The total order is for 30.

New Seversky trainer for the U. S. Army Air Corps

The Seversky trainer is a low-wing, all-metal monoplane with a maximum speed of 176 mph, making it the fastest training plane in the Air Corps.

Examples of its rugged construction are found in the ten points of attachment of the wing to the fuselage; monocoque construction of both fuselage and wings; and a fin built integral with the fuselage. A sliding canopy enclosure protects the pilot and instructor from the weather, or the enclosure may be removed.

In the cockpits are complete radio and navigational instruments for instrument flying and landings. A feature of the trainer is its interchangeable landing gear. Within an hour the plane can be made into an amphibion by the addition of pontoons. These pontoons are so constructed that they may be used for emergency landings on snow, ice, mud or heavy sand.

PRIVATE FLYING

Safe Flying

Miscellaneous aircraft operators flew 536,403 miles per fatal accident in the last six months of 1935, exceeding a half million miles flown per fatal accident for the first time in any half year on record. In the last half of 1934 miles flown per fatal accident were 392,141.

Miles flown per accident of any kind were 55,032 in the last half of 1935, an advance over the corresponding period of 1934, but not as high as the totals recorded for some other previous six-month periods.

Total number of passenger fatalities in miscellaneous flying during the six months from July to December, 1935, was 51; pilot fatalities numbered 67.

There were 809 accidents to airplanes of miscellaneous flyers during the period, causes of which were divided as follows: Personnel errors, 52.55%; engine failures, 16.30%; airplane failures, 12.95%; weather, 6.29%; darkness, .37%; airport, terrain or water, 7.21%; other causes, 3.40%; undetermined and doubtful, .93%.

Events

The First Annual Championship Air Races will be held at Denver, July 3-5, when pilots will compete for more than $10,000 in cash prizes. More than $300,000 in improvements on Denver's airport are nearing completion and this field will be in excellent condition before the meet opens.

Denver also will be the site of the 1936 National Balloon Races at the same time. At least six entries are assured for this event for which $1,500 in prize money already has been posted by the Denver Mile High Air Race Association.

James R. Ewing will be air race director.

* * *

The Oklahoma City Aviation Club and the Tulsa Airmen's Club are sponsoring the Oklahoma State Air Tour which will take place June 11-13. It is anticipated that there will be from thirty to forty ships in the tour, carrying from sixty to one hundred passengers and pilots, who in the three days will visit twenty-two airports and fly 845 miles.

* * *

The second annual Toledo News-Bee Aviation Day will be held June 14 at Transcontinental airport. Al Williams, Harold Neuman, Gordon Mougey, Bill Sweet, Lieut. J. C. Mackey and Earl Stein are expected to take part. Last year more than 75,000 spectators witnessed the event.

* * *

More than 25 airplanes left Love Field recently on a four-day Texas State Air Tour which served as a good-will mission for the Texas Centennial Exposition. Hal Henning, Dallas Stinson distributor, was in charge.

* * *

The Sixth annual Birmingham Air Carnival will be held June 6 and 7 at the Municipal Airport. The Birmingham Aero Club and the city of Birmingham are the sponsors with Steadham Acker serving as general chairman.

CLUBS

Activities

A flying club has been organized in Lynchburg, Va. with 11 members, who plan to purchase a new Taylor Cub. The club will operate from Preston Glenn Municipal Airport, and at present meetings are held twice a week in a club house loaned to the organization by the City Park service.

* * *

The first meeting of the Metropolitan Gliding and Soaring Association was held in New York City. Like the Soaring Society of America, the purpose of the organization is to co-ordinate the various clubs and individuals actively identified with the sport of soaring.

* * *

Annual election of officers of the Indianapolis Aero Club for 1936 resulted in the election of Louis Schwitzer, Jr., president; Titus Frankenfield, vice-president; and Frank Rippingille, secretary.

* * *

In the annual report of the Flying Clubs of America for 1935, it was disclosed that 56 persons were trained to fly at an average cost of $48 each; that the average time per member to point of solo was 6 hours, and that 650 hours were logged during the year.

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"He was a fine looking bronzed youth standing there on the Cleveland airport ready to take the run into New York. You could see his chest swell with pride and a glitter come to his eyes, when you asked him about those silver wings on his lapel . . . Or perhaps he was a native boy in Shanghai, now a member of the Chinese Air Service"—for, you will find these youths all over the world, these boys who speak with such pride when they tell you they are members of the DAWN PATROL.

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SCHOOLS

New Laboratory

Manufacturers and engineers of the Pacific Coast will be able to test performance of transport planes in a new aerodynamic laboratory equipped to meet modern problems and being built at the University of Washington.

Chief feature of the new laboratory is a wind tunnel, capable of generating a wind of 250 mph velocity. The laboratory, which adjoins the Daniel Guggenheim Aeronautics Building on the campus at Seattle, will cost $120,000, and will be ready for use of graduate students in aeronautics at the opening of the next academic term.

Approval

Lincoln Airplane and Flying School, Lincoln, Neb., has just received from the Bureau of Air Commerce its certificate as a Government Approved Repair Station. This school holds a Transport rating as a flight school, and also a Government-approved mechanics rating. It has completed construction of new departments for general aircraft repair work.

Equipment

Spartan School of Aeronautics has just completed installation of modern radio equipment consisting of high-powered telephone and telegraph transmitters, public address systems, and receivers, to be used in connection with its radio course. The School is also equipping the sheet metal department with new equipment so that students enrolling in the future will receive instruction in the latest methods of airplane construction.

* * *

Oklahoma Military Academy, Claremore, will receive from the Materiel Division, Wright Field, a BP-6 plane and one engine which are being loaned for ground work instruction.

Enrollments

Eleven members of the Illinois National Guard Air Corps are taking training at Aeronautical University, Chicago. The school now has an enrollment of 239, with 96 taking the aeronautical engineering course.

Complete sheet metal equipment has been added to the shop, and a new radio course has been added to the curriculum.

* * *

Brayton Flying School, located on Lambert, St. Louis Airport, announced through Clyde Brayton, president, the enrollment of 10 students. The students, listed for flight and mechanic instruction, represent the registry for February 1 to March 6.

* * *

Eighteen students have enrolled for flying at Commercial Airport in the recently inaugurated Aeronca Flying School at Tulsa, Okla. W. D. Gibson, chief instructor, states that only Aeronca planes are used for training purposes.

Personnel Notes

Burchard W. Wilson has been added to the instructor staff of the Mechanic's School of the Curtiss-Wright Technical Institute. He will be in charge of sheet-metal production methods, an advanced phase of sheet-metal construction.

* * *

The Boeing School of Aeronautics announced the addition to its staff of instructors on a part-time basis of Royal A. Roberts, Associate Professor of Economics at the University of California, and George W. Lupton, a member of the California Bar. Professor Roberts has been engaged to lecture on principles of salesmanship, publicity and advertising. Mr. Lupton will teach commercial and transportation law.

* * *

Professor Peter Altman, head of the Aeronautics Department at the University of Detroit is giving a series of lectures on practical aerodynamics and aircraft engines to personnel at Selfridge Field, Michigan. These lectures are given twice a week and will continue through until the end of July.

* * *

C. W. Trout of the Air Reduction Sales, Inc., gave a lecture and demonstration to a group of 75 students of the welding class at the Rising Sun Aircraft School, Inc., of Philadelphia. He illustrated various uses of Liquid Oxygen, how it was stored and what takes place at different altitudes during flight. He also explained various methods of welding different metals and how to apply the torch in order to get the best results.

THE INDUSTRY

Factory Expansion

Douglas Aircraft Company's new structure, which will be used for final assembly work, is expected to be ready for occupancy by the middle of June.

Many unusual details feature this new unit which has a clear span of 250 ft. Incorporated in the arched roof construction is a saw-tooth window design. In addition, two walls of the building and the entire sliding door arrangement adjoining the airport are glazed. Unobstructed height from floor to rafters is 30 feet.

The building has a floor space of 85,500 sq. ft., and this taken together with two other new units that have a combined area of 285,000 sq. ft., more than doubles the size of the present factory.

* * *

Greenfield Tap and Die Corp., Greenfield, Mass., makers of screw cutting tools, have acquired the plant and business of the J. M. Carpenter Tap & Die Co., Detroit. This plant will be operated as a branch of the Greenfield concern and will be under the management of Alfred LaPierre.

* * *

Wilkening Manufacturing Co., Philadelphia, Pa., manufacturers of *Pedrick Hydraulic* piston rings, let a contract for 22,500 sq. ft. of additional manufacturing floor space to be housed in a modern one-story monitor type building.

* * *

Occupation of their new factory recently purchased in Cleveland is announced by Simplex Products Corp.

* * *

Construction of an assembly unit costing more than $250,000 was begun last month by Boeing Aircraft Co. on a 28-acre tract adjacent to Boeing Field.

Sufficiently large to accommodate nine fully assembled Boeing 299 four-engined bombers, the new structure will measure 204 ft. × 304 ft. × 53 ft., with an unobstructed floor space measuring 200 × 300 ft. and with interior overhead clearance of 35 ft. In addition, there will be a one-story power house, 35 × 50 ft., for a heating plant, transformers and compressor equipment.

Award

An award in memory of Lawrence B. Sperry, pioneer in instrument flying and air navigation will be given annually for outstanding achievements in aeronautics by young men.

The Fund totals $10,000 and will be administered by the Institute of the Aeronautical Sciences, which will give a certificate and $250 in cash to a young man who, in the opinion of the Award Committee, has made "the greatest contribution to the advancement of aeronautics during the year for which the award is presented."

* * *

The Edward Longstreth Medal of the Franklin Institute of the State of Pennsylvania was awarded to Elmer A. Sperry, Jr., of Sperry Gyroscope Co., Inc., for his work in the development of blind flying instruments including the gyro-horizon, directional gyro, and the airplane gyropilot.

Aircraft Show

New York City will be host to the National Aircraft Show for 1937. Conducted under the auspices of Aviator's Post 743 of the American Legion, the show will be housed in the four floors of the Grand Central Palace from January 28 to February 6. Gustave A. Parsons will be in charge and Sam Taylor Moore will direct publicity. C. S. (Casey) Jones is commander of the Post.

The show which has the sanction of the Aeronautical Chamber of Commerce will be the first in seven years in New York. To provide the greatest possible attendance visitors are being invited from South America, Europe and Asia.

(*Continued on following page*)

Artist's sketch of Boeing assembly unit being built by Austin Company

CLEAN, DUST-FREE OIL is important to dependable lubrication. That's why Kendall brings you its quality oil in refinery-sealed cans which fully protect it against contamination. Kendall is refined 100% from Bradford Pennsylvania Crude. You can get Kendall at most airports throughout the country.

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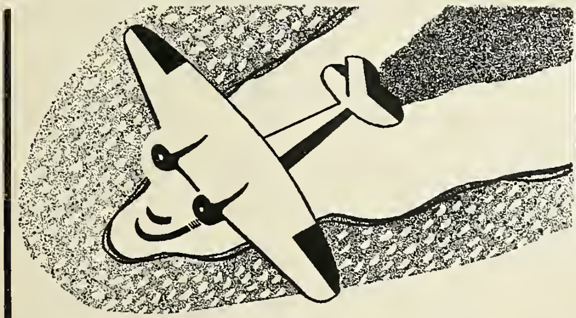

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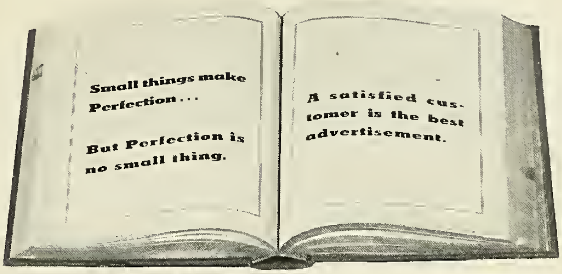

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(Continued from preceding page)

Production

Information from the Aeronautical Chamber of Commerce discloses an upward trend in manufacturing activities. Commercial airplane production in February was up more than 50% in value from January, 1936, and compared with the same month a year ago was up 33% in number, although 21.8% less in value.

Airplanes produced in February numbered 60 commercial and 174 military; in January production showed 38 commercial and 53 military units. Engines produced in February were 143 for commercial purposes and 153 for military use, while corresponding figures for January show 145 and 130.

Transport planes produced in February accounted for 7 out of the total commercial production, and in January for 5 out of the total commercial production. Total production value was up 75.6% from February of last year and 99.3% from February, 1934.

Deliveries showed about the same general relationship as did production, with few exceptions. The average value per unit delivered in January was $21,939 for military and $9,019 for commercial airplanes, and $7,313 for military and $3,531 for commercial engines. Corresponding figures for February are $16,489, $8,340; and $6,865 and $3,073.

* * *

During April, 37 "New Cubs" were manufactured by the Taylor Aircraft Co. This represents a 76.2% increase over April, 1935, when 21 "Cubs" were manufactured.

Business Reports

North American Aviation, Inc., reported a net profit of $33,869.17 for the first quarter of 1936, after deducting depreciation charges of $180,045.87. According to J. H. Kindelberger, president, this compares with the loss of $36,798.28 for the similar period in 1935, after deducting depreciation charges of $149,802.31.

* * *

Irving Airchute Company's plant in Fort Erie, Ont., was reopened last month to fill a contract calling for 75 parachutes, most of which are for Canada.

* * *

Deliveries and orders on hand of the Stinson Aircraft Corp. amount to more than $1,250,000 so far this fiscal year, B. D. DeWeese, president, announced. Export business was the largest in the company's ten years of existence, and more deliveries have been made and more orders are on hand for the Stinson Reliant than in any previous year.

* * *

Net profit of United Aircraft Corp., for the quarter ended March 31, 1936, was $350,952.03, equivalent to 16¢ a share on 2,109,561 shares of capital stock which will be outstanding when all exchanges for common stock of United Aircraft & Transport Corp. have been effected. This amount includes 21,779 shares of stock issued to March 31 against subscription warrants for 417,555 shares, which expired April 13.

* * *

Val Dietz, Jr., sales manager of the Flightex Department of Suncook Mills, reports that export business has shown increases each month. *Flightex* has been adopted as the standard Grade "A" covering in more than ten foreign countries at present.

* * *

Bendix Aviation Corp. purchased a substantial interest in the Jaeger Watch Co., assuring cooperation in design and manufacture of precision instruments between Jaeger, the Pioneer Instrument Co., and the Jaeger Co. of France and Switzerland.

Plane Sales

An order for 50 new Cubs was placed with the Taylor Aircraft Co. by Bennett Air Service, Hightstown, N. J.

* * *

Among recent purchasers of the 125 hp Ryan S-T is Dr. F. M. Boldridge of Charlotte, N. C. The sale was made through Air Service, Inc., Atlanta, Ga., Ryan distributor for the southeast.

* * *

Beckwith Havens and Richard H. Depew, Jr., Fairchild distributors at Roosevelt Field, report sales of five new Fairchild "24" three-place cabin planes. One went to Christian E. Born, the sale being made through Gillies Aviation Corp., Fairchild dealer at the Aviation Country Club. Others go to Robert Winslow, A. C. Bemis, George Humphreys, and E. W. Wiggins, the latter being Fairchild dealer in Rhode Island.

National Races

According to Clifford Henderson, managing director of the National Air Races, this event will be held in Los Angeles, Calif., from September 4 to 7 inclusive. An extensive improvement program now under way at the Cleveland Municipal Airport made it necessary to hold this year's races at another field.

(Continued on following page)

Wright-powered Howard DGA-8 for four persons

Digest of Recent Events

Sergievsky Sets Two More Altitude-Load Records

The twin-engined Sikorsky S-43 amphibion established its third and fourth world records at Stratford, Conn., when it reached an indicated altitude of 20,000 ft. with a 2000-kg. load. Capt. Boris Sergievsky was in command of the craft and he was accompanied by Igor Sikorsky. The flight established a mark for other amphibions to shoot at inasmuch as the records were the first to have been classified for amphibions with a 1000- and 2000-kg. load. Previous records set by the S-43 were with 500-kg. loads. APRIL 26

American Altitude Mark For Women Set By Gipson

A new national altitude record for light planes carrying a passenger was claimed by Annette Gipson who climbed over the Ft. Lauderdale, Fla., municipal airport to an estimated height of 14,000 ft. Miss Gipson was flying a Lambert-powered Monocoupe with Mrs. John F. Buckman as passenger. APRIL 27

Hawaiian Clipper Makes Record Pacific Flight

A trans-Pacific record was claimed by the Martin flying boat *Hawaiian Clipper* after completing a flight between Alameda and Manila in 57 hours 48 minutes flying time. The previous record for the 8000-mile route was set last December by the *Philippine Clipper* when it reached Manila in 58 hours 42 minutes. The record for the eastbound crossing is 58 hrs. 48 min. MAY 8

Buck Flies 2000 Miles Non-Stop For Record

Bob Buck flew more than 2000 miles non-stop in a light plane to set a new distance record. Taking off from Burbank, Calif., the pilot and his passenger, Lee Bellingrath, landed at Columbus, Ohio. The flight was made without a landing gear, the unit being purposely dropped at the start. The old record for light planes was set in 1930 by a French team that flew 1809 miles. MAY 9

Hughes Flies From Chicago to Coast in 8 Hours

Exactly 8 hours 10 minutes 25 seconds after he took off from Chicago, Howard Hughes landed at Grand Central Air Terminal, Glendale, Calif., to set a new unofficial non-stop flight record between these cities. Hughes was flying the Wright Cyclone G powered Northrop in which he set the present transcontinental record of 9 hours 25 minutes and the Miami-New York record of 4 hours 20 minutes. The fastest previous time on record between Chicago and Los Angeles was 12 hours 45 minutes established by a TWA Douglas, but Roscoe Turner had negotiated the distance in better time in an unofficial test. MAY 14

Hindenburg Sets Trans-Atlantic Marks

Completing her first passenger flight from Europe to the United States in the record time of 61 hours 38 minutes, the German dirigible *Hindenburg* landed at the Naval Air Station, Lakehurst, N. J., with 51 passengers. The return flight was made with 48 passengers who were flown from Lakehurst to Frankfort on the Main in 48 hours 28 minutes which cut 6 hours 54 minutes from the westbound flight mark set by the *Graf.* MAY 14

Amy Mollison Sets New Cape Town-England Records

All records for flights between England and Cape Town were broken by Amy Johnson Mollison when she landed at Croydon Airdrome to complete a trip from Cape Town in 4 days 16 hours 16 minutes. Mrs. Mollison made the outward flight in 3 days 6 hours 26 minutes, beating Flight Lt. Tommy Rose's mark by 11 hours 11 minutes. On the return journey, the time was lowered by 1 day 14 hours 41 minutes. Her flying time from England to Cape Town and return was 7 days 22 hours 42 minutes, compared with the old record of 10 days 34 minutes. MAY 15

★ WACO *C-6 Series $7295 to $9650*

ASK ANY PILOT...

★ WACO *S-6 Series $4995*

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★ WACO *F-6 Series $7095 to $8775*

ASK any pilot or Waco owner why the 1936 Waco is the best buy in the field. Ask him why Waco far outsold all 4-5 place cabin planes domestically in 1935 —*nearly equalled the combined total sales of all other makes*—in addition to doing the largest export business in the history of the company! It's because of Waco's . . .

RUGGEDNESS—Sturdy construction for which Wacos are famous assures long life and low maintenance cost . . . The 1936 Wacos are built for years of hard service.

ADVANCED DESIGN—No manufacturer is more alert to trends and progressive developments than Waco. When an engineering development is incorporated in a Waco, you can be sure it's "tried and true."

MANEUVERABILITY—Particular attention has been devoted to landing characteristics of the 1936 models, making them outstanding even among Wacos for their slow approaches under absolute control, and their ground-gripping stops.

COMFORT—Cabin interiors are comfortable to the point of luxury, noiseproofed, perfectly heated and thoroughly ventilated—designed with every consideration for the ease and convenience of pilot and passengers. Roomy luggage compartments are accessible during flight.

PRICES—Wacos for 1936 are offered at lower prices than ever before. Starting at $4995, the cabin series is available with varied specifications and equipment for every use.

Whether you want an aeroplane for business or for pleasure, you'll find just the right model in the Waco line—and you may purchase it from income rather than capital. Call the Waco dealer near you, or write to the factory, for full information.

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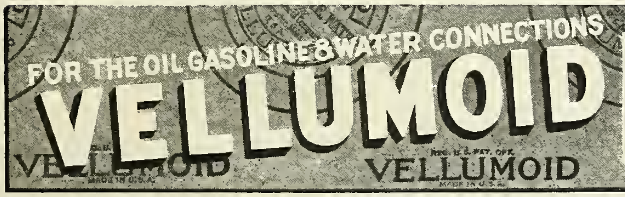
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(Continued from preceding page)

Approvals

Approved type certificates covering aircraft and engines were issued by the Bureau of Air Commerce to the following:

Stinson Aircraft Corp., Wayne, Mich.; model SR-7B, 4-place cabin monoplane powered by a Lycoming R-680-6 engine (245 hp). ATC 594.

Taylor Aircraft Co., Bradford, Pa.; model J-2, 2-place cabin monoplane powered by a Continental A-40-3 engine (37 hp). ATC 595.

Aeronautical Corporation of America, Cincinnati, O.; model Aeronca LA, 2-place cabin monoplane, powered by a LeBlond 70 engine (70 hp). ATC 596.

Waco Airplane Co., Troy, Ohio; models DQC-6 and YQC-6, 4-place cabin biplanes powered by Wright R-760E-1 (285 hp) and Jacobs L-4 (225 hp) engines, respectively. ATCs 597 and 598.

Wright Aeronautical Corp., Paterson, N. J.; model Cyclone GR-1820G-2, nine-cylinder radial, air-cooled engine, rated 850 hp at 2100 rpm at 5800 ft. ATC 157.

Pratt & Whitney Division, United Aircraft Manufacturing Corp., E. Hartford, Conn.; model Twin Wasp, fourteen-cylinder, radial, air-cooled engine, rated 900 hp at 2450 rpm at 6500 ft. ATC 158.

Bombers For Export

Thirty-one airplanes, to be equipped as attack-bombers for a foreign military power, are now under construction in Los Angeles at the new factory recently occupied by the Airplane Development Corp. Amount of the contract for the planes, which basically are the Vultee transports, is $1,000,000.

* * *

An order for 13 twin-engined bombers was received by the Glenn L. Martin Co. from the Netherlands Government. Construction of the planes involves an expenditure of $1,500,000. Work on the contract already has begun.

5-Place Stinson

Stinson Aircraft Corp. has designed the SR-8 Series *Reliant* to meet the demands of private flyers and operators for an airplane capable of comfortably carrying five persons.

As a result of wind tunnel tests it has been possible to widen the *Reliant* fuselage and to provide a 52-inch rear cabin seat which is equal to the rear seat in larger automobiles. Front seats are more commodious and an aisleway of greater width is provided between the two front seats. No loss of speed resulted from the changes.

The five-place *Reliants* are equipped with controllable-pitch propellers and are available with the Lycoming 245 and 260 hp and the Wright 285 and 320 hp engines. Cruising speeds range from 140 to 157 mph respectively and gross loads are 3650 lbs. for the 245 hp Lycoming, 3700 lbs. for the 260 hp Lycoming and 3800 lbs. for the Wright-powered models.

1,287,375 Passengers

Miscellaneous aircraft operators flew 84,755,630 miles in 1935, the highest miles flown total in a year since 1931, according to the Bureau of Air Commerce. Passengers numbered 1,287,375, slightly less than the 1934 total but exceeding the totals for 1933 and 1932.

Miscellaneous operations include charter and taxi flying, student instruction, crop dusting and photography, experimental and exhibition work, and private flying.

Dealers

A. W. Whitaker has been appointed distributor for the Taylor Cub. Whitaker has his headquarters in Portland, Oregon.

* * *

Cook Aeronautical Service, Inc., Bowman Field, Louisville, Ky., has just taken over the Kentucky dealership for Aeronca planes. Officers are F. S. Cook, president; J. T. Thomas, vice-president and treasurer; and L. D. Deters, secretary. One Aeronca C-3 is now being used for student work, solo flying, and aerial advertising.

Personnel Changes

Lester D. Seymour has been appointed vice-president and general manager of Pitcairn Autogiro Co. He will survey the sales and development policies to be pursued by the Pitcairn company with regard to the roadable and direct take-off autogiros now being developed by the Autogiro Company of America.

* * *

Officials of the Taylor Aircraft Co. recently announced the promotion of Walter Jamouneau to the position of chief engineer. Edward R. Burn, who has been with the company for the past 18 months now fills Jamouneau's former position as production consultant, and Prof. George B. Thorpe, of Carnegie Institute of Technology, is now the consulting engineer.

* * *

New directors elected to the board of the Boeing Airplane Co., and its subsidiary, Boeing Aircraft Co., are Philip G. Johnson, former president, and Paul Pigott. C. N. Monteith has been named executive vice-president, and R. J. Marshall, chief engineer. Claire L. Egtvedt, president, and other officers were re-elected.

* * *

At the annual meeting of the Daniel Guggenheim Medal Fund, Maj. E. E. Aldrin was re-elected president; Sherman M. Fairchild, vice-president; Maj. L. D. Gardner, secretary; and John H. R. Arms, treasurer.

* * *

Guy W. Vaughan, president of Curtiss-Wright Corp., announced the election of Burdette S. Wright as president of Curtiss Aeroplane and Motor Co. Wright succeeded Ralph S. Damon, who resigned on December 31, 1935 to accept a position with American Airlines.

* * *

H. F. McCulla has been named chairman of the Lincoln, Neb., Chamber of Commerce aviation committee for 1936. Ken Ott is vice-chairman.

* * *

Thorleis Holthe, factory superintendent of the Sikorsky Division of United Aircraft Manufacturing Corp., is now in England where he is acting as technical advisor for the British Aircraft Manufacturing Co., Ltd., licensee for Sikorsky S-42 flying boats. The company is building a factory at Hamble and plans to start production of the first S-42 some time in July.

* * *

Marion P. Crews, listed in the April issue of Aero Digest as chief engineer of the American Eagle-Lincoln Aircraft Corp., has since 1932 been associated with the Manufacturing Inspection Service of the Bureau of Air Commerce. Through an oversight Aero Digest was not notified of this change at the time the issue went to press.

March Exports

During the first quarter of 1936, aeronautical exports attained a total value of $3,333,304, bringing the monthly average slightly below 1935.

March exports totaled $1,289,077, including $393,048 for 24 airplanes and $581,272 for 96 engines. Parachute sales abroad brought $40,139, and parts and accessories $274,618. March, 1935 exports were valued at $1,735,542.

Most business in March was done in China, whose purchasers bought $449,375 worth of American products, including 48 engines worth $358,500 and $90,875 worth of parts. Sales in Czechoslovakia brought $180,286 and in Australia, $133,986.

Planes were exported to Australia (5); Mexico and the Philippines (3 each); Czechoslovakia, Canada, Uruguay and Japan (2 each); and to Finland, Germany, United Kingdom, Arabia, and New Zealand (1 each).

Engines were also imported by purchasers in Argentina (9); Canada (5); Peru and Hong Kong (4 each); Netherlands and Panama (3 each); Czechoslovakia, Mexico and Brazil (2 each); Spain, United Kingdom, Honduras, Jamaica, Chile, Colombia, British Guiana, Arabia, Japan, Philippine Islands and Australia (1 each).

Coming Events

Annual Display, R.A.F. Flying Club, England. June 6

●

1936 Missouri State Air Tour, sponsored by Lambert-St. Louis Airport Association. June 12-14

●

Second Annual Toledo *News-Bee* Aviation Day, Transcontinental Airport, Toledo, Ohio. June 14

●

Second Annual Intercollegiate Air Meet, auspices Intercollegiate Flying Club, Wayne County Airport, Detroit, Mich. June 19-20

●

Fifth Annual Roosevelt Field-Montreal International Good-Will Flight. June 20-21

●

Seventh Annual Coffeyville Air Meet and Air Races, Coffeyville, Kan. municipal airport. June 21

●

Eighth Annual Indiana Air Tour, auspices Indiana Aircraft Trades Association, Indianapolis. June 22-28

●

Royal Air Force Display, Hendon, England. June 27

●

Seventh Annual Soaring Contest, auspices Soaring Society of America, Elmira, N. Y. June 20-July 5

●

Denver Mile High Air Races and 1936 National Balloon Races, Denver Municipal Airport, Denver, Colo. July 3-5

Kings Cup Race, England. July 10-11

●

Coupe Armand Esders Speed Race, Deauville-Cannes, France. July 25

●

Aviation display and aerobatic competition in conjunction with Olympic Games, Templehoff Airport, Berlin, Germany. July 31

●

International gliding demonstration in conjunction with Olympic Games. Templehoff Airport and on the Wasserkuppe. August 4

●

Dominion finals, John C. Webster Memorial Competition, Kingston, Canada. August 23-24

●

1936 National Air Races, Los Angeles, Calif. Sept. 4-7

●

Deutsche de la Meurthe Cup Race, auspices Aero Club of France, Etampes Montdesir Airport. Sept. 13

●

Paris-Saigon round-trip speed race, sponsored by Aero Club of France. October 25

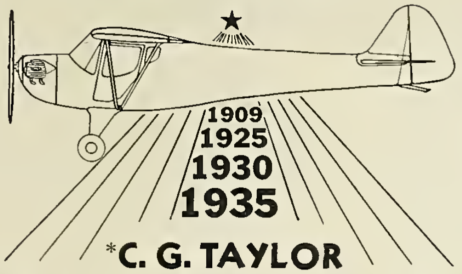
●

International Aviation Show, Grand Palais, Paris, France. November 13-29

●

National Aircraft Show, auspices Aviator's Post 743, American Legion, Grand Central Palace, New York, N. Y. Jan. 28-Feb. 6, 1937

IT'S NO ACCIDENT –



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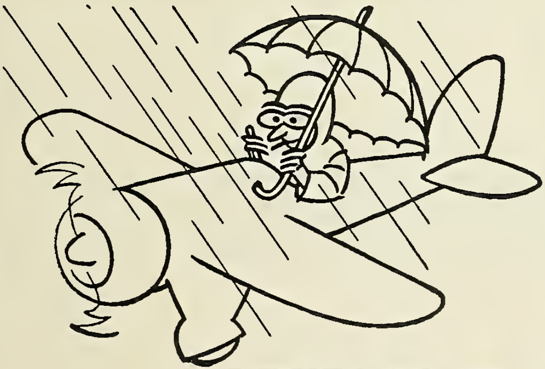

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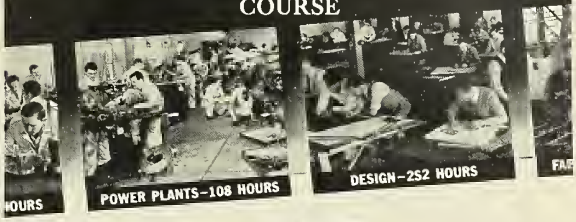

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FOREIGN NEWS IN BRIEF

◆

Australasia

It is expected that the Civil Aviation Department will recommend that the Federal Ministry spend £350,000 on radio equipment for the Australian air routes. The cost of maintaining these services is estimated at £60,000 a year, and the cost of the necessary equipment on aircraft at £1000 per machine.

Competing against six other entrants, J. J. Larkin earned the title of champion of the Royal Aero Club of N.S.W. for 1936. Tests included blind flying and forced landings. The championship places the pilot at the head of the club and as leader of formation flights.

The Adelaide (South Australia) State centenary executive has decided on a prize of £1000 for an interstate centenary air race, to finish at Parafield on December 18. This race will be flown in three stages, the distance yet to be decided, but it will probably include Sydney, Melbourne and Adelaide.

Since the ban on American aircraft was lifted by the Commonwealth Government, several American-built planes have been ordered for operation on airlines and for private owners. The latest private owner to order American aircraft is G. Faulkner, of *Haddan Rigg* Station, who has purchased a de luxe Waco.

Canada

A new international air passenger service has been established between Seattle and Vancouver, B. C. by Canadian Airways, Ltd., which will fly the Seattle-British Columbia mail. On the initial flight to Seattle recently guests were entertained by Vancouver and Canadian government officials.

Dominion finals of the annual John C. Webster Memorial Competition will be held in Kingston August 23 and 24. Finals will be preceded by elimination meets at all flying clubs in Canada, and will be held under the direction of a committee appointed by the Minister of National Defence.

Two more Noorduyn *Norseman* are scheduled for delivery as soon as they are completed. The first, for MacKenzie Air Service Ltd., is of the combination freight and passenger carrying type. It will be delivered as a landplane, but will be equipped with Edo floats on its arrival.

The second plane goes to Robert Cockeram of Prospectors Airways, primarily fitted as a private plane which is convertible for freight and passenger work. It will be delivered on Edo floats.

The Brant-Norfolk Aero Club has employed Tom Senior as flying instructor. The club held its annual spring meet May 23-25.

Radio directional equipment is being placed on the Newfoundland-Montreal route of the proposed trans-Atlantic airway. Equipping of this portion of the route with direction-finding radio stations is understood to be part of the agreement recently made between Canada and Great Britain in connection with the trans-Atlantic test flights to be made this summer.

A special six-passenger seaplane has been built at Longueuil, Quebec, for the British Air Ministry, the machine being used in preliminary flights in connection with the opening of the trans-Atlantic route this summer. Captain Douglas Fraser of Imperial Airways, is using the plane which is fitted with meteorological instruments, for observations off Newfoundland.

The financial statement of Canadian Airways Limited for 1935 showed an operating profit of $35,453, as compared with $43,668 in 1934. After provision for depreciation, taking credit for other income and deducting income tax of subsidiary, there was a net loss of $132,590, as compared with a net loss in 1934 of $167,654.

The Toronto Flying Club will soon own a new fast airplane on receipt of a four-place Gypsy-powered Percival Vega Gull from Viscount Wakefield. The plane has a maximum speed of 170 mph, cruising speed of 155, and initial climb of 700 ft./min. The new plane will be an aid to students in qualifying for commercial pilot licenses, and will make the eighth to be operated by the club this season.

Another $430,000 has been appropriated by Canada's parliament for the development of the principal training center of the Royal Canadian Air Force at Trenton, Ontario, on Lake Ontario. The field at Trenton with training quarters is to replace the war-time training center of Camp Borden, still in use. It is estimated that in the next 10 years the Trenton development will cost $20,000,000.

France

Starting June 3, Air France will operate a second daily service between Paris-Lyon-Marseille with connections to Marseille-Alger and Marseille-Tunis. From July 1 the airline between Paris-Brussels-Amsterdam-Copenhagen-Malmö will be extended to Stockholm.

Air Bleu has installed three radio beacon transmitters on its Paris-Bordeaux line. This installation, which is to be extended over all of the company's routes, consists of transmitters broadcasting on short wave lengths (8 or 9 meters), thus avoiding the swinging effect sometimes produced by short waves from 200 to 400 meters. Initial results have been satisfactory and it is thought that such radio beacons will soon be installed at all French airports.

The 6,000,000 francs appropriated by the Air Ministry for private aviation for 1936 will be distributed as follows: 1,000,000 fr. divided into 2000 premiums of 500 fr. each, for paying part of the fuel for pilots of the first category; 1,000,000 fr. half for clubs and half for private owners, as premiums for buying light planes; 2,000,000 fr. will be used by the Air Ministry for purchasing light planes for sale at low price to clubs; and 2,000,000 fr. for paying premiums to private owners and clubs for the purchase of touring planes.

A twin-engined Renault-powered Coudron C.440 *Goeland* has been demonstrated in Brussels to Belgian military officials. This plane, equipped with controllable pitch propellers, retractable landing gear and wing flaps, will be demonstrated by Pilot Reginensi in the Argentine, Brazil and Chile.

Breguet's chief test pilot, Marcel Detroyat, recently test flew the new twin-engined 46-T, an all metal cantilever monoplane powered by 820 hp Ghome-Rhone K-14 engines. The plane, known as the *Fulgur*, has a span of 67 feet, an overall length of 51 feet, and is provided with a retractable landing gear. Accommodations are available for 2 pilots and 12 passengers. Gross weight is 14,991 lbs., of which 2866 lbs. is useful load. Performance figures show a cruising speed of 211 mph at sea level, 224 mph at 16,500 ft. at 65% power, maximum speed of 239 mph at 6500 ft., and a cruising range of 544 miles. Fuel is carried in two 165-gallon tanks installed in the wings.

Great Britain

Daily air mail service between London and Lisbon with calls at Bordeaux and Madrid was started only recently. This service, operated by Crilly Airways, leaves London at 6 a.m. and arrives at Lisbon at 5:30 p.m.; the return flight starts from Lisbon at 8 a.m. arriving in London at 7:30 p.m.

Legislation, now before Parliament, proposes that the British Government expend approximately $132,348,600 in subsidizing civil aviation during the next eighteen years. Civil airlines, already subject to annual Governmental subsidies which in the aggregate may not exceed the equivalent of about $4,901,800 per year, would, under the provisions of this bill receive 50% more or the equivalent of about $7,352,700 annually. This sum represents the proposed gross liability of the Government in any fiscal year, and any contribution which may be made by Dominion or Colonial Governments toward the cost of the subsidies would be applied to reduce the liability of the central government. In addition to the proposed increase in subsidies, commercial aviation would also benefit by the intention to extend the period during which subsidies may be paid from December 31, 1940 to December 31, 1953.

The first British airliner fitted with apparatus to prevent ice formation on the wings and tail control surfaces is a deHavilland D.H.86a for Imperial Airways. It was put into service on the company's European routes.

The device deposits a liquid mixture of ethylene glycol and ethyl alcohol on the leading edges. The mixture lowers the freezing point of water and melts any layer of ice which contacts the surface, thus eliminating adhesion to the surface and enabling wind forces to blow the rest of the ice away. The mixture is led

(Continued on following page)

GENERAL AIRPLANE TIRES

MUD AND SLUSH GROUNDED ALL AIRLINERS EXCEPT STREAMLINE TIRE EQUIPPED PENNSYLVANIA TRANSPORTS

● Streamline equipped Pennsylvania Airliners were able to take off in a sticky blanket of mud and slush that grounded all other transports at the Washington Airport one day this Spring.

Mr. J. J. O'Donovan, Pennsylvania's traffic manager at Washington, states "Streamlined General Tires made it possible to operate all day out of here, while all other lines cancelled."

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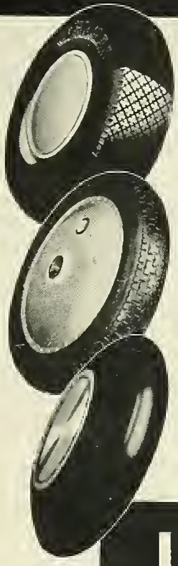

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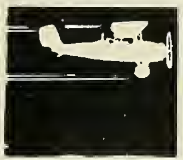

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Armstrong Whitworth "Whitley," newest R.A.F. heavy bomber, powered by Siddeley Tiger engines

(Continued from preceding page)

to the leading edges through piping and a rubber tube punctured at short intervals along its length. Liquid forced through this tube moistens a porous leather covering stretched along the leading edge.

First of a new commercial flying-boat fleet, a new four-engined monoplane, will make its initial flight toward the end of this month from Medway River, at Rochester. Six of these boats have been ordered by Imperial Airways for the Empire service. From the beginning of flight trials of the first machine, the production schedule is planned to complete successive craft at intervals of about three weeks, which means that the entire fleet of 29 concerned in the order should be delivered before the end of next year.

British air attachés to some countries abroad are to be supplied with aircraft for their own use to effect economies in territories where travelling expenses are high and to enable more work to be done by reducing journey times.

Attachés listed to receive aircraft serve South America, the United States, Germany, and the region covering Belgium, the Netherlands and the three Scandinavian states.

First of the new four-engined *Empire* monoplane flying-boats, of which a fleet of 28 is on order for Imperial Airways, will go into service in the Mediterranean as soon as its flight tests are completed. The second, equipped with long-range fuel tanks, will be prepared for long distance flights planned as preliminaries to establishment of regular trans-Atlantic service. The third will be shipped to North America for assembly in readiness for the service to be worked by Imperial Airways, in association with Pan American Airways, between the mainland and Bermuda.

Powered with four 900 hp engines, these boats are expected to have a maximum speed of about 200 mph and to cruise at 150-160 mph.

Railway Air Services, the company which combines Imperial Airways and four British railway groups in the exploitation of home air routes, plans an increase this summer of more than 50% over the route mileage operated last year. Services to the more popular holiday resorts will be greatly increased in frequency.

New routes will be opened. Three will serve holiday traffic between the Isle of Man and Scotland and the north of England. Two will link Bristol and Cardiff across the Bristol Channel with Weston-super-Mare. Another will link Cardiff, Weston-super-Mare, Southampton and the Isle of Wight. On some routes there will be as many as six services daily in each direction. In the south, services between London and the Isle of Wight will use the new airport at Gatwick (London South).

Demands of the R.A.F. expansion program have caused Saunders-Roe to build a new seaplane factory. In the main shop is room for the simultaneous building of 10 to 12 large flying boats in various stages of manufacture. The factory is at present busy on an order for twin-engined *London* biplane boats ordered by the Air Ministry for R.A.F. squadrons.

Japan

As a step to encourage gliding, Osaka Mainichi and Tokyo Nichi Nichi Newspaper companies have offered a prize of 10,000 yen to be awarded to the pilot making the first successful non-stop glider flight between Tokyo and Osaka—a distance of 265 miles. The flight must be undertaken not later than March 31, 1939.

According to the Japanese War Office, new army training planes of Series 95, types I, II and III will replace the existing training planes of the B-1 (Salmson 2A2) and E-1 (Hanriot H.D. 14).

Army 95-1 is a two-place biplane with a 350 hp air-cooled radial engine and will be used for advanced training.

Army 95-2 type is a monoplane fitted with 450 hp engine. This machine accommodates several persons enabling the instructor to fly with students for practical training.

Army 95-3 type is also a two-place biplane with a 150 hp engine. It is for primary training.

According to revised schedules for the summer, fixed by Japan Air Transport Co., air service between Tokyo and Hsinking via Dairen, and between Tokyo and Taiwan via Fukuoka will be expanded to provide 7 instead of 6 round trips a week.

Mexico

Air transportation in Mexico was further advanced in 1935 it is indicated by the report of the Ministry of Communications and Public Works showing that during the first half of the year, civilian planes carried 29,598 passengers; 1,668,908 lbs. of express and 851,659 lbs. of baggage in 11,955 flights that covered 1,821,890 miles in 16,966.01 hours. As compared with the corresponding period of 1934, increases were: passengers: 20 percent; express: four percent; baggage: 29 percent, and number of flights: two percent. A decrease of 15 percent was shown in distance flown.

Netherland India

At the end of 1935 Netherland India issued licenses for 27 planes, 74 pilots for private planes and 17 transport pilots. The Netherland Indian Air Line owns 14 of the planes of which 8 are Fokkers, 3 are of British and 3 of American manufacture. The flying clubs at Bandoeng and Surabaya possess 2 planes each; the former using Moths and the latter a Pander EG-100 and a Phillips and Powis Hawk.

South America

Legal authority was recently granted for the State of Sao Paulo, Brazil, to enter into a contract with Sao Paulo Airways, Inc., for furnishing air transport service, particularly between that city and Rio de Janeiro. This service is scheduled to start this month. The Government has agreed to pay a subsidy of $42,500 annually to the company and is authorized to purchase capital stock to the extent of $85,000. The municipality of Sao Paulo also invested $46,000 in the capital stock of the company. Sao Paulo Airway, Inc., will begin operations, therefore, with a capital investment by the State and municipality of $131,000, plus an annual subsidy of $42,500. The contract, which is valid for ten years, provides that the company shall maintain a service of two round trips daily between Sao Paulo and Rio de Janeiro. The airline distance between these points is 217 miles and it is planned to make the flight in 90 minutes.

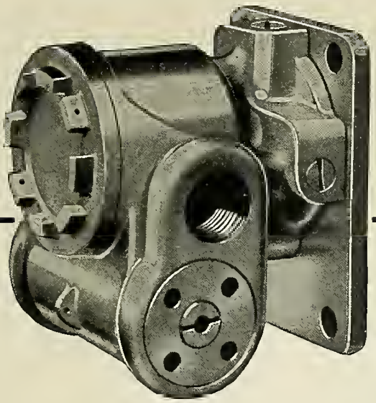
Passenger traffic between Sao Paulo and Rio de Janeiro has always been heavy and the new line will fill a long felt need. It will be particularly advantageous for business men, who can make the round trip on the same day transacting their business between planes. The present air service between Santos and Rio de Janeiro is inconvenient for Sao Paulo travellers owing to the two-hour train trip between Sao Paulo and Santos.

Sao Paulo Airways, Inc., has purchased two Junker tri-motor planes with accommodations for 17 passengers, a crew of 3, and capacity of 3,307 pounds of baggage. The planes are equipped with 350 h.p. engines and have a maximum speed of 183 m.p.h.

The Quilmes airport will be improved by leveling additional land, and the erection of buildings and repair shops. This field is about 12 miles southeast of Buenos Aires. Lighting equipment, radio facilities and a station building will be provided. The Civil Aviation Association, which is aided by the National Government, will move its operations to Quilmes from the Moron airport.

Uruguay has authorized the establishment of commercial air service between Montevideo and Salto. A three-year grant provides for carrying passengers, mail and express. The airline distance between the two points is approximately 260 miles.

The service which is scheduled to begin in about a month will be the first to operate exclusively in Uruguay and the first to serve the interior of the country. It will probably be extended later to include other cities particularly Artigas and Paysandu.



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TRADE LITERATURE

Synthetic Rubber

The first issue of *Thiokol Facts*, published by Thiokol Corp., manufacturers of a synthetic rubber of the same name, is an interesting pamphlet devoted to the story and general application of this product.

Uses of Thiokol in the aviation industry are pointed out. It is utilized for fuel hose and for sealing the fuel tanks of large transports.

Future issues of the new publication will carry specific information on new applications in the aviation field. Copies of this publication will be sent without cost upon request to the publishers in Yardville, N. J.

Alloy Steels

A new and comprehensive 106-page handbook is being currently distributed to users of alloy steels by Republic Steel Corp.

Not only does the publication present up-to-date chemical and metallurgical data on standard and special steels, but it outlines factors to be considered in their selection and heat-treatment. The applications of alloy steels for specific uses in leading industries are discussed.

Entitled *Agathon Alloy Steels* and profusely illustrated, this book is a contribution to the published literature on alloy steels. It should be of interest and value to those directly responsible for the selection and application of alloy steels for industrial use.

Boeing School

The purpose of the newest booklet recently issued by the Boeing School of Aeronautics is to give prospective students complete information about the various courses offered by the institution. It is designed also to serve as a vocational guide for individuals and for counselors in high schools and colleges. Tastefully put together and artfully illustrated, this publication leaves little to the reader's imagination relative to what the school offers in flight and ground instruction. Complete curriculums are provided.

Bearings

A comprehensive review of the principles affecting the selection, application and operation of anti-friction bearings, and ball bearings in particular, has been prepared by The Fafnir Bearing Co., in the form of an engineering manual totalling almost 200 pages.

Of interest is a complete and up-to-date resumé of the engineering fundamentals involved in correlating design requirements, load characteristics and service conditions to the choice of the particular size and type of bearing. Vector diagrams and load formulas for belt drives, chain and rope drives, spur gears, bevel and helical gears, worm gears, etc., reveal the customary forces acting on the bearing and the limiting factors which apply. Taken together with a complete tabulation of bearing characteristics, dimensions and capacities, the basis is provided for an analysis of almost any bearing problem within the covers of this volume.

The book is divided into five sections for easy reference. Section I reviews the history and development of anti-friction bearings, with emphasis on the improvement in characteristics which have expanded their fields of usefulness. In Section II, 30 pages are devoted to an analysis of bearing selection, on the basis of type, size, and desired life expectation. Section III reviews the dimensions, load ratings and functional characteristics of a complete list of bearing types and sizes, including industrial pillow blocks and roller bearings as well as ball bearings.

To those responsible for machine assembly and operation, and bearing maintenance, Section IV brings a review of shaft-fitting methods, housing and mounting instructions, and advice on lubrication.

Obviously, no bearing analysis can be complete without a correlation of engineering and economic factors. As Section V of the manual, a separately bound list of prices and weights, as of January 1936, has been included.

Air Traveler's Guide

In the past airlines have paid little, if any attention, to vacation travel, but this year several of the larger transport companies are initiating far-reaching campaigns to attract a considerable part of this type of travel to the airline.

The keynote of the campaign is the fact that by using air travel, vacationists can enjoy long holidays in distant points. United Air Lines has issued an *Air Traveler's Guide* to the nation's greatest playgrounds, one of the most complete booklets issued on this type of transportation and one which is more comprehensive than any literature of this type yet issued. An interesting section of the guide is the two-page map showing some of the vacation grounds near or on the mid-continent route flown by United.

Radio

Radio transmitter models AVT-7, 7A, 12 and 12A are described and illustrated in two new brochures just issued by the RCA Manufacturing Co., Inc.

Useful information includes the summaries of electrical features and installation drawings.

BOOK REVIEWS

INTERNATIONAL ORGANIZATION IN EUROPEAN AIR TRANSPORT

By Laurence C. Tombs

At the outset of the conference for the Reduction and Limitation of Armaments it was recognized that the problem of the air was one which involved both what was officially known as "civil aviation" and what was known as "military aviation." Especially in the air commission of the Conference, which met in the first half of 1932, and in the air committee set up in the early spring of the following year, numerous proposals to overcome, or seriously to diminish, the military potentialities of "civil aviation" were either formally presented by delegations or thrown out during the prolonged discussions. Of all these proposals, that which aroused the greatest interest and the most marked differences of opinion was the "internationalization of civil aviation," and there were several varieties of this particular proposal. Often linked with it was the idea of the establishment of an "international air police force."

It is possible, even probable, that it was not always realized by delegations at the Conference, or by the governments and public at home, that from the year 1919, the very first year of civil air transport, a process of internationalization had begun, for flight is, by its very nature, international. This process, in various spheres, has advanced slowly but steadily ever since.

The purpose of this book is not to support the idea of the internationalization of civil aviation, or any other policy. It is rather to indicate what are the existing elements of international organization in European air transport, how such elements have come about in the face of national reactions, and what is their real significance.

THIS FLYING GAME

By Arnold and Eaker

The authors, Brig. Gen. H. H. Arnold and Maj. Ira Eaker, have compiled a most interesting book, one that fits particularly the needs of the younger generation. It answers most of their questions—how to get into aviation, what training they must have, and other topics puzzling the youthful mind with reference to aviation.

However, rather than imply that the book is for the younger generation only, it might be pointed out that it is designed also for all readers interested in aviation. It is profusely illustrated and well, though simply, written. The authors venture in their final chapters into prophesies concerning the future of aviation, bringing to a close a work which, to many, will be found interesting as well as instructive.

DIESEL AIRCRAFT ENGINES

By Paul H. Wilkinson

A concise and up-to-date review of the latest developments in Diesel engines and their equipment for aircraft use, the 1936 edition of *Diesel Aircraft Engines* is a semi-technical book published by the author and compiled in easy-to-read form. It not only depicts what has already been accomplished, but also suggests the probable trend of Dieselization in the aeronautical field.

Outstanding is the chapter, "Modern Diesel Aircraft Engines" because of the treatment of the description of 14 modern types, with information supplied in the metric as well as the English system of measurement. Engines are uniformly treated, with illustrations on one page faced by a tabulated description on the other. Interesting also is the section on superchargers as used on Diesel aircraft engines, and the treatment of new topics in Dieselization which heretofore have received little or no consideration.

Chapters apt to create interest are those on the advantages of the Diesel for airline operation, the tabulations of various Diesel aircraft engines, and the prognostication of Diesel development.

The presentation, contained in 160 pages, is enhanced by 88 large illustrations and drawings. The quality of the stock and the appearance of the book are excellent.

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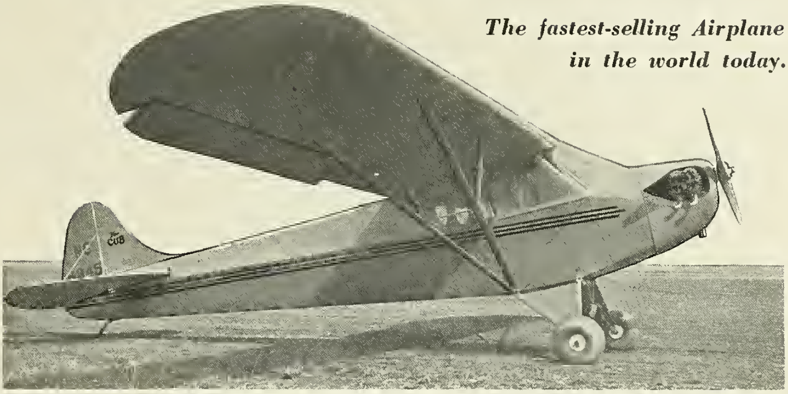

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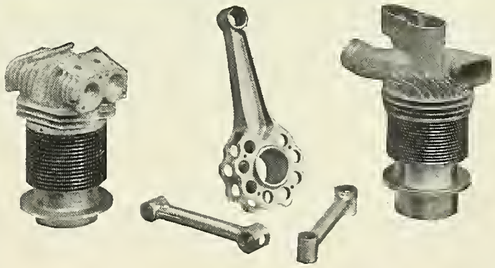

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Airspeed	Envoy (Overseas)	8	1	400	174
de Havilland	89 Dragon Rapide	10	1	500	157
de Havilland	Dragon	10	1	450	128
de Havilland	Express Liner	16	2	350	170
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General Aircraft	ST 18	10	2	450	187
Handley Page	H.P. 42	38	4	450	127
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Saunders Roe	Cloud Amphib.	8	1	400	131
Short	Scipio	15	3	450	137
Short	Scion (Sr.-Land)	10	1	400	140
Short	Scion (Sr.-Sea)	10	1	400	134
Short	Scylla	39	4	450	137
Spartan	Cruiser MK IV	6	1	400	133

BRITISH MILITARY PLANES

(*Continued from page 29*)

at the situation of national defense shows that London is only 100 miles from the French coast and 130 miles from the nearest point in Belgium, but that Berlin is 520 miles from the English coast and Paris 210 miles away. In short, the British bombers must be designed for a minimum range of more than 1000 miles with full load, a requirement necessarily differing from those of neighboring countries. For defense purposes (since London and other important centers are so near the English coast) the fighters or interceptors must be able to overtake and destroy enemy bombers within a space of 40-50 miles. To carry out such a mission they must possess high rate of climb and maximum speed. The Fairey *Fantome* (described in Part I), one of the latest experimental models produced in this class is an example of such types having a maximum speed of 250 m.p.h. at 16,000 ft., a climb of about 3000 ft./min., and carries four machine guns, a 20 mm. cannon, and four 22-lb. bombs.

In design of both the fighter and bomber, the trend is away from the biplane and toward the low-wing, multi-engine type with flaps. Both metal and metal- and fabric-covered types with stressed skin monocoque structure are found on the latest designs, along with fully retractable landing gear (including tail wheel) and completely enclosed cockpits. Enclosed turrets for gunners fore, aft and below the fuselage are becoming prevalent. Development of the “moteur-canon” is receiving unusual attention in England, spurred on by advances made within the past two years in France with this type of weapon. It is being generally realized abroad that fighters are almost useless unless they are equipped with one or two of these guns. What chance has one fighter with two, four, or even six machine guns trying to attack a formation of bombers having five to six guns apiece and a steady machine gun platform to fire from? The answer to this is the “moteur cannon,” which has a flat trajectory of nearly 500 yards and fires an explosive 1-lb. shell, which will cripple or destroy an enemy ship with a single well-placed shot from a distance twice that at which the machine gun is effective. Heavy bombers are being provided with light “moteur-canon” ranging from 20-37 mm., firing shells of up to 1.5 lbs. at a rate of almost 600 rounds a minute. Fighters are also being designed to carry similar “cannons” firing ahead between the engine cylinders or out of mechanically-operated turrets. The armament of fighters is leaning toward the use of from 4 to 6 or even 8 machine guns, operated by compressed air, placed in channels in the wings. The advantage of this for ground strafing is obvious. Complete details of the “moteur-canon” will be given in a later article in Aero Digest on “French Military Aircraft.”

Type and Number of Squadrons	Maximum Speed (mph)	Total horsepower	Weight Loaded (lbs.)
ARMY COOPERATION			
Audax (16)	180	600	4700
Wapiti (4)	140	550	5400
FLEET SPOTTER RECONNAISSANCE			
Osprey (2)	175	630	8200
Walrus (2)	150	580	8000
Shark (3)	150	525	7870
Seal (3)	160	525	7900
COASTAL RECONNAISSANCE			
Southampton (1)	140	1300	—
Scapa (2)	—	1220	—
Rangoon (1)	123	1575	—
Singapore III (2)	145	2240	27,500
Perth (1)	133	2475	32,500
RECONNAISSANCE AND GENERAL PURPOSE			
Anson (2)	188	620	7650
Bristol 142 (1)	268	645	—
Bristol 120 (2)	180	670	5200
Hardy (1)	170	575	4900
H.P. 47	195	670	5000
Dragon	135	260	4500
PV—4	185	670	5400
G 4/31	180	670	8350
Vincent (1)	142	620	8100
Wellesley (1)	200	670	10,000

The *Pterodactyl* type is being given considerable thought as this design affords excellent visibility and practically unlimited angle of fire from the rear cockpit. Two, four and five place autogiros are being developed for army cooperation work.

Engines are taking a decided trend toward two distinct classes—the 12-cylinder Vee water-cooled, and the 14-cylinder radial air-cooled. Full steam cooling is being developed to the point of unusual efficiency. Engine design for shorter hours between major overhauls is naturally increasing h.p. output as compared with engines designed to give 150 or more hours of service.

In general, a comparison between British military aircraft and that of the U. S. seems to indicate that individually, ship for ship, the latest interceptors are as fast as our pursuit types but that in the bombing category the British lag behind. The same situation is apparent in long range seaplanes and flying boats—the Sikorsky and Martin types being far advanced to similar English types.

VIDAL STATISTICS

(*Continued from page 25*)

groaned Senator Clark. “It is very much confused to me in my mind, this statement, and it appears to me from the statement the witness just made that it is an actual deteriment to have these aids. And if so Congress ought to know about it and prohibit the airway aids.”

Senator Clark read some startling figures regarding lack of maintenance of aids, supplied by Jay Mount, who forever seemed to be popping into the record. He was evidently cast as the snake in the Bureau's Garden of Eden, and the Honorable Mr. Johnson had been unable to scotch him. Senator Clark read from Mount's statement that the total average for all districts which were not inspected in accordance with the regulations, was 54.4 per cent. This shocked everyone, including Vidal, who said at once, “That fortunately did not contribute to any of the crashes, no, sir.” And Senator Copeland remarked with gentle irony, “I do not see, Senator, why you press the matter. Mr. Vidal is of the impression that we do not need these aids.” Senator Clark shook his head, like a bull being bothered by flies. “I want to find out whether we need them or not,” he persisted. “If we do not need them Congress ought not to appropriate any money for them, and ought to forbid their use if they are dangerous.” He never found out.

Vidal's testimony veered around (like the swinging beam at Jacksonville) to the matter of Pilot Graves' landing at Kansas City under the minimum ceiling requirement, for which a violation was placed upon the pilot. “That is to say,” remarked Senator Copeland, “because he came in, landed and got his passengers in alive, in spite of that he must be fined $500 because he violated a regulation. I suppose poor Bolton is lucky he did not come in, because if he had come in he

(*Continued on following page*)

View of Porterfield Model 70 airplane in front of the Administration Building on the airport at Belgrade, Yugoslavia. ***It has been flown half way around the world by its owner who writes that he has done all of this flying without a hitch.***

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(*Continued from preceding page*)

would have been fined $500." (Bolton was the pilot of the Cutting plane, and died in the crash.) "$500 for what is supposed to be a safety regulation," added Senator Clark. "Has any effort been made to collect that $500 from Pilot Bolton's estate?" inquired the Chairman acidly. "That is the general enforcement section, Senator," volunteered Mr. Schroeder. Into what a morass the incompetence of officials has led a government department! Surely the President cannot help but be embarrassed by the actions of his appointees.

Mr. Martin Takes the Stand

The vacuous and vacillating Vidal was followed on the stand by the suave moustachioed Rex Martin, Assistant Director of the Bureau of Air Commerce. Mr. Martin wears pink shirts and thinks nothing of it.

He opened the first of two bulky volumes of typed pages, from which he began to read in a quiet voice, looking up every few lines to wiggle his moustache slightly and to observe how Senator Copeland and Senator Clark were taking it. The Senators were taking it very quietly, somnolently, in fact. They were resting. Mr. Martin read on, and on. Nobody bothered him; he bothered nobody. Some of the audience yawned. I went quietly to sleep, to be awakened by Fred Neely, who whispered, "You're in contempt of the Senate," to which I replied, "No, in contempt of Rex Martin," and went to sleep again.

After an adjournment, hearings were continued with only Senator Copeland present—Senator Clark apparently was worn out. The indestructible Rex Martin resumed his readings. The name of Jay Mount, that snake in the Garden of Eden, popped up again. The firing of Mr. Mount still rankled in Senator Copeland's breast. The Senator apparently felt strongly that poor Mr. Mount hadn't been done right by. After recounting some of the sad details, he said to Martin: "Is that right?"

"I do not know as to details," replied Mr. Martin smoothly. "But," persisted the Senator, "you know the result?" "I know the result, yes, sir," agreed Mr. Martin.

"That is all right," replied Senator Copeland. "That is exactly the way I understand it. I think that this man Mount walked the plank because he told us what he did."

Mr. Martin looked sympathetically at Senator Copeland. He knew how the Senator felt about it—the Senator is a kindly man, and it evidently hurt him to think that poor Mr. Mount had been thrown to the sharks. Mr. Martin is a sympathetic man, too, filled with the skim milk of human kindness. As I left, he was again going into his act, apparently to divert the Senator.

"Quoting," began Mr. Martin gently and soothingly, "quoting from the Office Memorandum, August 14, 1935: The matter of installing a standard property accounting system for the Airways Division was one of the topics brought up for consideration in a conference of Lighthouse Superintendents here in Washington, March 7 to 12, 1932. Herewith is a copy of an excerpt——"

I stole quietly away. I couldn't wait until Mr. Martin had worked his way back through the early history of aviation, back to the days when balloons were tried in the Civil War. I know he'll get to it, sooner or later.

SALES POSSIBILITIES

(*Continued from page 38*)

types at North Beach Airport in New York, has 21 full-time employees, has the concession for Stanavo gasoline and Mobiloil, and offers storage and service facilities for any type of aircraft. While as extensive an organization as this in South America might exceed present demands, a small fixed based operation built along similar lines would undoubtedly get enough business from South Americans to more than meet expenses. If a sales agency for some American aircraft was added to these operations, and if flight instruction was given in American-made planes, it is conceivable that business would more than meet expectations.

ANNUAL CONFERENCE

(*Continued from page 50*)

not depend on the method of cooling nor on the speed of air.

In addition to essentially new research reference was made to continued progress of various work reported last year. In Diesel engine research a demonstration was given of a single cylinder with a bore of 5″ and a stroke of 6″, operating at 2000 rpm. The power output was 68.5 bhp with 200 lbs./in.^{2} of BMEP, at 10 lbs./in.^{2} of boost pressure. Pressure gradient through baffles was also studied. In the study of injection, the manifold and cylinder injection was compared to carburetor performance. An electrical flow meter was constructed which in view of its small size can be used as an addition to flying instruments.

Other Studies

Various fillet studies indicated possible improvement with the use of an additional leading edge fillet. However, no general fillet shape can be recommended since fillet design is a function of body wing coordination and is individual for different arrangements.

The effect of propellers on maximum lift leads to the conclusion that with propeller locked or wind milling the maximum lift coefficient remains substantially the same (about 1.67) while with full power it is found to be 2.1 (apparently the figure is given for the area in the slipstream). High lift devices are being studied continuously this year the emphasis having been placed on take-off improvement. The external airfoil is considered the best take-off device since the drag increase is small as compared to split flaps. Lateral control investigation disclosed that the promise held out by lip-slot aileron suffered a setback under free flight conditions and its merit is regarded as questionable. Stability calculation data is being continued, the data shortly to appear being on lateral contral.

Numerous other problems were presented and discussed, but space limitations do not permit mentioning them in detail in this summary.

PERSONAIRLITIES

(*Continued from page 62*)

Then he flew the Minneapolis-Chicago run for Universal; was assistant to Paul Goldsborough in charge of operations at Chicago, was later in charge of the Universal Flying School system at St. Louis, and from that went to the St. Louis-Chicago run. Placed in charge of airways, he built the St. Louis-New Orleans airway for the company, which included lights from Jackson to New Orleans, then returned to flying a run, first the St. Louis-Memphis, then the Fort Worth-Cleveland Division which he is on now, flying Douglas DCs and Condor Sleeplanes. He has flown every type of transport plane built in this country with the exception of the Boeing 247 D. While barnstorming in the early days he had the usual run of minor accidents, but since joining the airlines in 1928 he has not had a single accident. That incident of the disappearing engine can hardly be classed as an accident, you know. Mac only used that engine to get up; he got down by using his head—a triumph of mind over motor. And isn't that name McFail about as incongruous as the name inherited by our friend Jimmie Doolittle?

In the biography of Pilot Mal B. Freeburg in the May issue of Aero Digest, we failed to mention that Mal had been awarded the Air Mail Flyer's Medal of Honor for his superlatively fine job of piloting in getting his ship and passengers down safely after bombing a farm with one of his engines.

The introduction for Abe Warner's biography in the April issue had contained mention of this award to Mal Freeburg. When lack of space necessitated holding Mal's sketch for May, it was inadvertently run without any introduction. Sorry, Mal. I hope this apology and explanation catches up.

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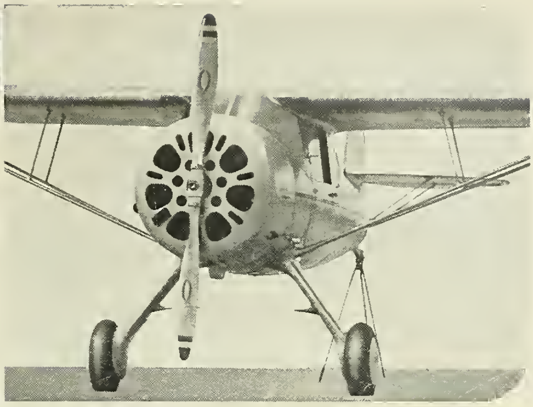

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19.	Elements of Aviation	*Clark*	1928	3.00	1.50
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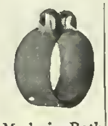

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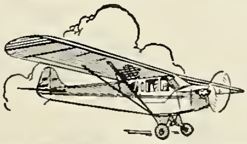

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BUHL PUP: 45 h.p. demonstrator; 65 hours total time. This ship is perfect; wings need recovering. $350. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

BUHL PUP: Identified; ready to fly anywhere. New crankshaft. All reasonable offers considered. Troy Air Service, Inc., Troy, New York.

BUHL PUP: Szekely 45 horsepower; motor and ship in excellent condition; some extras; licensed to December; excellent ship for building time; $465. Arthur Edwards, Airport, Fort Dodge, Iowa.

BUHL PUP: Recently majored; excellent condition; always hangared; cracked, price, $375. Richard Carson, Cbambersburg, Pennsylvania.

BUHL BULL PUP: Szekely just majored; heavy crankcase, aluminum noseplate, steel barrels. Fuselage reinforced and refinished, tail group dedoped. Compass, ball bank. $400. L. E. Dufty, 1703 St. Paul Street, Baltimore, Maryland.

Cessna

NEW CESSNA Demonstrator: 145 h.p. Warner. Extra equipment: turn and bank, rate of climb, RCA radio, retractable landing lights; $4,500. Sundorph Aeronautical Corp., Cleveland, Ohio. Cessna Distributor.

CESSNA J6-9: Night flying and instrument flying equipment. RCA radio. Aerol struts. Streamline tires. Excellent condition; $2,750. Sundorpb Aeronautical Corp., Cleveland, Ohio.

CESSNA C-34: Warner 145. Six months old. Like new. Landing lights, flares, radio, starter. $4,300. Will take trade and finance. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Command-Aire

BARGAIN: Command-Aire de luxe 3-place; late type Challenger 185; compass, airspeed, metal propeller just etched, brakes, inertia starter. Just relicensed. $850. Lester Jolly, Devils Lake, North Dakota.

COMMAND-AIRE: 150 horsepower Hisso. Total engine time, 50 hours. Steel propeller, new Bendix wheels, fuselage and tail group recovered. Licensed until April 1937. Ship in excellent condition. $700 cash, or will trade for smaller plane. Cook Aero Service, Inc., Bowman Field, Louisville, Kentucky.

OX COMMAND-AIRE: Fuselage just recovered. Wings refinished. Just relicensed to May 1937. $475; $237.50 down. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Curtiss Jr.

CURTISS JUNIOR: Licensed; motor and ship in excellent condition. Economical and dependable to build up time. Price, $385 cash. W. H. Mason, 1801-19th Street, Parkersburg, W. Va.

Curtiss Thrush

CURTISS THRUSH: J6-7, 6-place. Engine and airplane in excellent condition. Finest passenger carrying ship ever built. Wheel pants. Cruises 105. $1,475; $737.50 down. Accept trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Curtiss Robin

ROBIN: New late type Challenger, color blue and silver; bank and turn, standard steel, battery, landing lights; total plane, 610 hours, since recovering, 28 hours; total engine, 27 hours. Ship absolutely in A-1 condition throughout. Recovering, new engine and other work cost more than asking price. Will ferry to demonstrate for deposit. $1,275 takes it. Serv-Air, Inc., Raleigh Municipal Airport, Raleigh, North Carolina.

CURTISS ROBIN: OX good, $335. Arrow Sport; Aircat LeBlond, $385. Norman Kramer, Syracuse, Kansas.

OX-5 ROBIN: Identified, in flying condition; needs recovering to license. Motor runs fine. First $300 cash takes it. Tiffin Flying Service, Tiffin, Ohio.

CHALLENGER ROBIN: Licensed. Motor majored. High finish, new upholstering, steel prop, starter, will deliver or teach buyer; $850. Monty Barnes, 638 Pattie, Wicbita, Kansas.

CHALLENGER ROBIN: Excellent condition. Motor 50 hours since majored. Price, $900. Will take trade on lighter ship. Adolpb Farkas, 187 East 95th Street, New York, N. Y.

CURTISS ROBIN: Excellent condition; 20 hours since top overhaul. 65 hours major. Inertia starter, speed ring. $1,050. A. E. Rogers, 420 E. 21 St., Brooklyn, N. Y.

Davis

FOR SALE: LeBlond 60 Davis. Licensed until October 1, 1936. Willis Hammonds, Omaha, Arkansas.

Eaglerock

FOR SALE: OX Eaglerock, just relicensed until March 1937. Is in good shape, ready to fly and priced to sell. Call or write Wicbita Falls Air Transport Co., Wichita Falls, Texas.

BUY NOW: Two OX-powered Eaglerocks; one stressed up to 220 h.p., recently recovered; both in good flyable condition. Price $375 and $275, or will trade for late model automobiles. Write for details. Central Air Service, Grand Rapids, Mich.

Fairchild

KR-34 FAIRCHILD: J6-5 motor, Hamilton propeller, 30" x 5" wheels with brakes; licensed August 15, 1936. Covering good. 425 hours on ship and motor. Proctor Holcomb, Simsbury, Connecticut.

FAIRCHILD KR-21: 100 Kinner. Ship and engine in A-1 condition. Hamilton steel propeller, semi-airwheels and brakes. Exceptional buy at $1,050. Ray Hylan, Rochester Airport, Rochester, New York.

FOR SALE: Fairchild KR-34, J6-5 motor. New steel Hamilton prop. Tail wheel, speed ring, brakes, lights, baggage compartment, standard instruments. 65 hours motor, 460 hours on ship. Recovered completely and painted April, 1936 and licensed. Color: cream, trimmed red. $1,500 cash or will trade for high wing monoplane. J. C. Cox, Concord, North Carolina.

FAIRCHILD 22: Rover. Blind flying; glazed finish. Like new. Whitneys Jewelry Store, Lake City, Florida.

FAIRCHILD CABIN 24: Two-place. Warner motor. Red and black. Excellent condition throughout. Just relicensed. Special leather upholstery. White Flying Service, Caldwell-Wright Airport, Caldwell, N. J. Phone: Caldwell 6-1560.

J6-5 FAIRCHILD KR-34: Speed ring, pants, semi-air wheels, navigation and landing lights; hand-rubbed cream and blue finish; under licensed A & E's care; always hangared. Licensed until November 1936. $1,200 cash, or trade on Waco F. Write W. W. Edmondson, Clover, Virginia.

Fleet

WARNER FLEET: With spare Warner engine. Ship and both engines, only $1,400. Ray Acre, 5300 West 63rd Street, Chicago, Illinois.

WARNER FLEET: Just completely recovered. Turn and bank, rate of climb, brakes. Licensed June, 1937. $1,395. Will finance or take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Franklin

FRANKLIN SPORT: Lambert 90 h.p. motor. Total time 163 hours. Good condition. Red fuselage, orange wings. Full air wheels. Good trainer. $1.000. A. G. Becker, Dravosburg, Pennsylvania.

Great Lakes

GREAT LAKES: De Luxe T-1A. Motor, Cirrus, just majored, heads, rods, pistons, etc., new; ship excellent. Relicensed December. Upholstered cockpits, air wheels; Hamilton propeller. Completely overhauled. $1,375. Also new and used Cirrus parts. John F. Tilt, 902 American Bldg., Dayton, Ohio.

GREAT LAKES 2T-1A: No time since overhaul. New covering, motor overhauled. Licensed till June 1937. Air wheels, nickel plated struts. Looks like new. Write Gordon O. Brown, 513 River Avenue, Alma, Michigan.

FOR SALE OR TRADE: Great Lakes 2T1. No time since motor majored and ship refinished. Licensed to January 1937. Wanted: Kinner Bird. R. A. Swenson, Williston, North Dakota.

Heath

HEATH PARASOL: Model LN; A-40 motor, completely overhauled. Ship as good as new. 30 hours total time. D. E. Ranere, White Horse Pike, Hammonton, New Jersey.

Kinner

KINNER SPORTWING: Kinner B-5. Total 300 hours. Winter top. Never damaged. Privately owned. Cost $5,000; year old; price $2,900. J. S. Maxfield, 420 North West 17 Street, Oklahoma City, Oklahoma.

Laird

LAIRD SPEEDWING: 330 h.p. Tops 182. Long cruising range. Special white and black paint. 40 hours since majored. Karl Voelter, All American Airport, Miami, Florida.

Lambert

LAMBERT DE LUXE Monocoupe: 1936. Radio with generator. Complete instruments include turn and bank, rate of climb, cabin heater; new, only 50 hours. Sacrifice $1,000 off. H. W. Moore, 420 Davis Avenue, Dayton, Ohio.

VELIE MONOPREP: Like new; majored and hand-rubbed finished by approved station. Only one in country like it. Townend ring. Monocoupe enclosure. Oleo struts. Bargain for $650. Charles E. Adams, 213 County Building, Detroit, Michigan.

LAMBERT MONOCOUPE: Beautiful red finish; new pyralin throughout; Kollsman sensitive altimeter, bank and turn; Eclipse electric starter. Priced right. Inquire Joseph L. Gray, Lake City, Florida.

MONOCOUPE WARNER 125: Motor No. 897. Shielded and bonded for radio. 180 hours since major, 8 hours since top. Ship just refinished, like new. Steel propeller, speed ring, pants and tail wheel. Privately used. A real bargain at $1,750. W. T. Saxon, Cedar Rapids, Iowa.

LATE 1934 DE LUXE Lambert Monocoupe: Tunnel cowl, pants, flaps, wide 1936 landing gear, float fittings. tail wheel, etc. Fine condition throughout. 320 hours; top overhaul. Stearman vermilion. $2.200 at Miami. Gustavo Bustamante, P. O. Box 2772, Miami, Florida.

$650 BUYS VELIE MONOCOUPE: Split type landing gear. Modernized cowling. Motor just majored. Licensed until May 1937. Beautiful rubbed finish. Efficiency Fuel Oil Co., 4517 Maryland Avenue, St. Louis, Missouri.

VELIE MONOCOUPE: Licensed. Exceptionally good condition. Leather upholstering, high finish; 60 hours since motor majored. Take trade, $585. Monty Barnes, 638 Pattie, Wichita, Kansas.

VELIE MONOCOUPE: Perfect condition, hand-rubbed finish, compass, airspeed, bank indicator, clock, etc. Must see to appreciate. V. E. Millard, 824 Belmont, Chicago, Illinois.

LAMBERT MONOCOUPE: Licensed, semi-balloons, brakes, racing landing gear, pants, speed ring. $900 cash. Frank J. Miller, McConnell Field, Nashville, Tennessee.

DE LUXE LAMBERT MONOCOUPE: Perfect condition; engine just factory overhauled; two doors, radio, blind flying instruments. Donald D. Cooke, 325 East 57th Street, New York, N. Y.

NEW DE LUXE LAMBERT Monocoupe: Less than 100 hours; RCA radio, all blind flying instruments; generator, electric starter, flares, retractable landing lights, special long distance gas tanks, specially designed and lighted instrument panel (metal), thermocouple. Absolutely perfect condition; "give-away" at $2,850 cash. Not one cent less. C. C. Taliaferro, 2425 Delaware Avenue, Wilmington, Delaware.

125 WARNER MONOCOUPE: Latest type enclosed valves, completely streamlined, 260 hours, never damaged, A-1 condition, looks almost like new, $1,950. Irving Tier, Airport, Meriden, Conn.

VELIE MONOPREP: 32-foot wing. Licensed, perfect condition; air wheels, air speed, compass, navigation lights. $400. Howard W. Slusser, 640 N. Vine Street, Hazleton, Pennsylvania.

MONOCOUPE: Fast ship, Warner-powered; cruises 130 m.p.h. Recovered a year ago, motor having top overhaul now; price, $2,000. Ingals, Box 136, Natick, Massachusetts.

1936 DE LUXE Lambert Monocoupe Demonstrator: 160 hours total; just top overhauled. Has starter and battery. Cannot be told from new. $3,100. 1934 Monocoupe De Luxe: 100 hours total; battery and starter. Painted red and cream. $2,300. 1934 De Luxe Monocoupe: 300 hours. Red and cream. $2,100. Waco Distributors, Inc., State Airport, Hillsgrove, R. I.

LAMBERT MONOCOUPE: Motor factory rebuilt, steel propeller, brakes, airwheels; never damaged, privately owned; relicensed May; 355 hours. $1,525. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

LAMBERT MONOCOUPE: Berry red; racing type gear; new tires, ring; motor completely overhauled, with kit; run in test only; new fuselage, wing recovered. Equivalent new ship. Price, $1,695. Kenneth G. Schneider, Anniston, Alabama.

Lockheed

FOR SALE: Wasp Lockheed Vega. Arthur C. Goehel, Phillips Petroleum Company, Bartlesville, Oklahoma.

LOCKHEED AIR EXPRESS: Total time under 500 hours. Both plane and Wasp B engine just majored. 187 gallons gasoline. Ship just relicensed and like new. Will sell with or without engine. C. M. Ewan & Co., 210 West 55th Street, New York, N. Y.

New Standard

2 D-25 STANDARDS: J-5 motors. 1 total time 400 hours, 80 since major overhaul. 1 total time 800 hours, motor just majored, no air time. Any reasonable offer considered. Sansom, 157 Charter Oak Avenue, Hartford, Connecticut.

J-5 STANDARD: 5-place, motor in excellent condition; direct electric starter, flares, landing and navigation lights, tail wheel, steel propeller, covering very good. Milton Hersherger, Put in Bay, Ohio.

NEW STANDARD Sport Trainer: Kinner B-5 front exhaust. Has steel prop. duals, brakes, extra fuselage tank, semi-airwheels, full set instruments, including bank and turn, compass, rate of climb and Heywood starter. Ship licensed; everything in perfect condition. Price, $1,200. Address, Fred Ramhorst, 6 Laurel Place, R. D. 4, New Brunswick, N. J.

Pitcairn

PA-6 PITCAIRN: J-5. Ship and motor just had major overhaul. Goodyear Airwheels and brakes. A bargain at $1,150. AERO DIGEST, Box 2323.

PITCAIRN MAILWING J6-7-E: No time since major at Wright factory. Completely recovered, many instruments including artificial horizon, electric starter. radio and flares. Priced for quick sale. Sam Held, Hangar 6, Floyd Bennett Field, Brooklyn, New York.

J6-9 330 H.P. PITCAIRN Mailwing: This ship is in excellent condition and loaded with instruments. Fully equipped for blind and night flying, electric starter, steel propeller and powered with Wright E-type motor. Trade accepted or terms if desired. Edw. A. Forner, Jackson, Michigan.

Porterfield

PORTERFIELD: LeBlond 70. Dual brakes, ring, position lights, compass, airspeed, tail wheel, very little time on ship and motor. Located in midwest. Sell or trade. AERO DIGEST, Box 2312.

Rearwin

FOR SALE: Rearwin Sportster, $1,650. LeBlond 70. Ring, compass, air speed, air wheels, special paint. New September 1935. Total 165 hours. A beautiful job. Jean Rockwell, 5914 Hartford Street, St. Louis, Missouri.

Ryan

PARKS-RYAN 3POLB: Wright J6-5 170 h.p. Excellent condition, less than 500 hours. Just recovered, special 25-coat dope job. Glass windshields, lights, large luggage compartment, brakes, new tires; always hangared, never cracked. A safe, brilliant performing ship. William Squier, 2001 Chevrolet Avenue, Flint, Michigan.

RYAN B-5: J6-9 motor. Licensed until April 1937. Air wheels, air starter, Pyle landing lights, new battery, Wiley flares, wing reconditioned. Beautiful ship. $1,800. D. F. Burns, 1003 Corona St., No. 2, Denver, Colorado.

RYAN B-5: 6-place; Wright J-6 powered. Beautiful two-tone high gloss finish, perfect condition. 100-gallon tanks. Price, $1,875. Richmond Air Transport, Richmond, Virginia.

Savoia-Marchetti

SAVOIA-MARCHETTI Amphibion: Kinner-powered. Heywood starter. Fully equipped. A real buy at $1,000 cash or terms. Send stamp for list. Pioneer Aviation, Airport, Syracuse, New York.

SAVOIA-MARCHETTI: 3-place amphibion. Kinner-powered. Engine 150 hours since major; ship total, 385. Just relicensed. Color, silver and red. Heywood starter, compass, clock, rate of climb and level gauge. Ideal for use on lake or river. $750. Manager, Sunbury Airport, Sunbury, Pennsylvania.

Star

FOR SALE: Cavalier, two-place cabin; Velie engine. Flying condition. License expired since owner's death. Cash price, $285, to settle estate. Attorney: J. R. Dean, 208 Daniel Building, Danville, Illinois.

States

STATES: Two-place open tandem sport monoplane. Kinner K-5 engine. Cost $2,150. Approximately 150 hours since new. For quick sale, $1,100 cash. Air Activities, Inc., Municipal Airport, Houston, Texas.

Stearman

STEARMAN C-3-B: Motor J-5. 225 hours since major. Steel prop, bank and turn, shielded and bonded for radio. Flare holders. 80-gallon gas tank. Licensed to October 15, 1936. Brinckerhoff Flying Service, College Park Airport, College Park, Md.

STEARMAN: Wright J-5: Completely recovered, motor major overhauled; complete set of instruments. Price, $1,500. Muncie Aviation Corp., Muncie, Indiana.

Stinson

WARNER STINSON: Motor majored. Licensed until April 15, 1937. Steel prop, new tires, good brakes. Will consider '32 Monocoupe or Eaglet in trade. R. W. Merrifield, Box 525, Aberdeen, South Dakota.

STINSON "U" TRIMOTOR: Three J6-7-E motors; 285 h.p. each. Only Wright-powered Stinson in world. Sensational performer. Only 700 hours. Latest model, 11 place. Perfect airliner, soundproof. Cruises 125, top 160. $4,750, quick sale. Western Airplane Distributors, 600 Graphic Arts Bldg., Kansas City, Missouri.

STINSON SM8A: Equipped for night flying. Approximately seventy hours since complete overhaul including recovering. Color black with cream trimming. Gray leather upholstery. Three 1½ minute electric flares. Will take Fleet or Bird in trade. $1,800. A. G. Becker, Bettis Airport, Dravosburg, Pennsylvania.

FOR SALE: STINSON SR-5E, flaps. 230 hours, none since overhaul. Cream and blue. Landing lights, flares, blind flying instruments wired for radio, large tanks. Priced reasonable. State Trade School, Putnam, Connecticut.

LYCOMING STINSON SM8A: Beautiful condition, leather interior, $1,100 cash or terms. Warner Stinson, $850. Buy the best from the reliable Pioneer Aviation Company, Airport, Syracuse, New York.

FOR SALE: $1,650; Stinson cabin, Lycoming; starter, Donut tires; recently majored and licensed. Privately owned. J. E. Blythe, 1108 East Admiral Blvd., Tulsa, Oklahoma.

FOR SALE: Stinson Reliant, Type SR-5, with 240 h.p. Lycoming engine which has just been factory overhauled. Equipment: New tires, flares, standard instrument panel, radio, landing lights, Smith controllable propeller. Williamsport Airport, Montoursville, Penna.

LATE 1934 LYCOMING Stinson Reliant: Flaps, Hamilton Standard propeller, special paint; cream fuselage, Stearman vermilion wings, hand-rubbed high-polish finish all surfaces. Large gas tanks, electric starter, air wheels, pants, turn and bank, sensitive altimeter, clock. Total time 285 hours. 25 hours since top overhaul. Finish, appearance and upholstery like new. $4,300. Booth-Henning, Inc., Love Field, Dallas, Texas.

STINSON SM8A: 4-place. Best buy in the Middle West. Licensed to February, 1937. Total time 380 hours. $1,400 cash only. For further details, write Mel Meyers, 1241 Paddock Hills Avenue, Cincinnati, Ohio.

STINSON LYCOMING SM8A: Direct electric starter, turn and bank, engine factory majored, air wheels, brakes. Best buy in middle west. $1,375. R. E. Searle, Ogallala, Nebraska.

STINSON J-5 four-place, very good shape throughout. Make me an offer. Will take car or ship on deal. H. B. Kaywood, 1013 First Street, Jackson, Mich.

STINSON MODEL W: Wasp Jr.; just relicensed. Black and silver. Covering excellent; turn and bank, rate of climb, flaps, thermocouple, air speed, compass, electric starter, special leather upholstery. $2,500. White Flying Service, Caldwell-Wright Airport, Caldwell, New Jersey. Phone: Caldwell 6-1560.

STINSON JR. (SM7B): Wasp Jr. (300) powered. Ship and engine in A-1 shape. Licensed till June, 1937. Starter, generator, landing and navigation lights, flares, bank and turn, rate of climb, air temperature, clock, radio, ring, pants, extra large fuel tanks, etc. Complete details and photograph on request. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

LATE MODEL SR-5 STINSON: Like new, powered with Wright E-type 250 h.p motor. Priced to sell. Edw. A. Forner, Jackson, Michigan.

STINSON TRIMOTOR: Model U. 10 passengers and pilot. 160 gallons gas. $3,500. Excellent condition. Austin Municipal Airport, Austin, Texas.

STINSON '33 RELIANT: 175 hours since major. Radio, landing lights, flares, 75 gal. gas, bank and turn, new battery, new tires. Excellent condition; always privately owned and flown. Maintained by airline. Eastern Aeronautical Corporation, Airport, Newark, New Jersey.

STINSON "S": Privately owned; 85 hours since completely reconditioned and engine majored at factory; fabric in excellent condition. Finish, black and silver. Special leather upholstering. Crosley radio with complete bonding and shielding. Bank and turn, rate of climb, retractable landing lights and flares; never cracked; price, $1,800. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

STINSON RELIANT: Built May 1934. Controllable pitch propeller, radio, landing lights, flares, turn and bank, rate of climb, starter, leather upholstery. 75 gallon gas capacity. $4,750. Will take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

STINSON SM8A: Perfect condition; less than 400 hours; 10 hours since majored and modernized; new tires and battery; licensed May 1937; never cracked; unusual buy; $1,600. Located Pennsylvania. AERO DIGEST, Box 2332.

LYCOMING STINSON R: Built 1932. Turn and bank, rate of climb, landing lights, flares. Condition perfect throughout. A rare bargain. $2,475. Will finance or take trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

Swallow

IDENTIFIED 3-place OX-5 Swallow biplane. Ship and motor in excellent condition. Motor top overhauled 27 hours back. Recovered 18 months ago. Dark blue and silver color. Has always been hangared. Price, $300. Kenneth Koelling, care Police Department, Blackwell, Oklahoma.

Taylor

TAYLOR CUB: Continental motor, winter enclosure. Ship rebuilt and recovered in January. Only 165 hours on motor. Guarantee ship like new. $800. Will consider late model car. Miss Lois Neal, 419 Lawson Street, Beaumont, Texas.

TAYLOR CUB for sale: Good condition, licensed and flying. Never cracked, under 400 hours. 1933 model. $795 cash. Honesdale Airport, Honesdale, Pennsylvania.

TAYLOR CUBS: Used, some like new. Real bargains, $850 to $1,050. Can be financed. Send stamp for information. Bennett Air Service, Central Jersey Airport, Hightstown, New Jersey.

1935 CUB: Licensed till May, 1937. 250 hours total, 75 since major. New propeller and late carburetor. Never cracked and now in good shape. $925 cash only. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

TAYLOR CUB: Continental A-40-3, nine months old, 250 hours total time, 30 hours since top overhaul. Never cracked, in perfect condition, $1,095. Will sell or trade for Porterfield, Monocoupe or similar small ship. Will deliver 350 mile radius of Amarillo. Bill Bowermon, Memphis, Texas.

TAYLOR CUB E-2: Continental engine. Just relicensed. Special paint job. Ship made altitude record of 14,300 feet. Price, $1,200. May be partly financed. Max Conrad, Winona, Minnesota.

FLY THE NEW Taylor Cub: Best light ship of the year. Will gladly demonstrate. Write or call for particulars. Reich Air Service, Roosevelt Field, Garden City, New York.

TAYLOR CUB: Powered with Continental A-40-3 motor, less than 100 hours time; only 7 months old and in perfect condition. Price, $1,000. Can finance for dependable party. Ingals, Box 136, Natick, Massachusetts.

TAYLOR CUB: Six months old. $1,045. Good as new. $522.50 down. Accept trades. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

TAYLOR CUB: A-40-2. Excellent condition; new enclosure. Buying new model; must sell quickly. First $725 cash takes it. Somerset Hills Airport, Basking Ridge, New Jersey.

Travel Air

J6-9 TRAVEL AIR 6000: 40 hours since overhaul by approved repair station. Relicensed to April, 1937. Complete night flying equipment, blind flying instruments, electric starter, generator, speed ring, semi-air wheels, complete ambulance equipment; 105 gallon gasoline capacity. Will consider lighter ship in trade. $2,600. Jimmie Johnston, Denver Municipal Airport, Denver, Colorado.

OX-5 TRAVEL AIR: Absolutely first-class condition, new covering, large 30 x 5 wheels, extra heavy landing gear, Curtiss metal prop, motor just majored, licensed to 1937; $425. Tidewater Air Service, 808 Bankers Trust Bldg., Norfolk, Virginia.

TRAVEL AIR S-6000-B: Wright R975-E, 330 h.p. engine. Only a few hours since complete $1,350 overhaul. Equipment includes radio, bank and turn and wheel pants. Make an offer. Air Activities, Inc., Municipal Airport, Houston, Texas.

TRAVEL AIR J6-7 Speedwing: Streamlined, including wingroot fairing, wheel pants, tripod landing gear. Cruises 140. Plenty instruments. W. W. Morrison, 729 S. Arlington, Akron, Ohio.

J-6 165 E-4000 TRAVEL AIR: Three-place biplane. License expires April 1937. Total time 450 hours. Price, $1,100. G. F. Monninger, 800 East North Avenue, Baltimore, Maryland.

Viking

KITTY HAWK SEAPLANE: In perfect condition. Motor just overhauled. Plane completely prepared for salt water. Price, $2,500. Viking Airport, Inc., Box 3302, Miami, Florida.

Waco

JACOBS WACO YKC: Built December 1934, total time 220 hours. Complete night equipment, radio, all instruments, 70 gallon gas tanks. Just majored and in top shape. Price $3,950 cash. American Aircraft Co., Portland Airport, Portland, Oregon.

WACO 1933 DE LUXE Cabin: 210 Continental. Radio, flares, landing lights, and extra instruments. Ambulance equipment. Little time. Excellent inside and out. Never cracked. $3,100. Karl Voelter, All American Airport, Miami, Florida.

WACO 9 OX-5: New motor, Millerized. Scintilla. New Sensenich prop, air speed, bank and turn, inclinometer, duals; covering good. Licensed. $325 or trade on Waco Warner "F". E. J. Seabold, 2415 W. North Avenue, Baltimore, Maryland.

WACO YKC: 225 Jacobs rebuilt at factory in May. Beautiful international orange rubbed finish; instruments, flares, lights, radio. Also Edo 3300 floats and struts in fine condition. Troy Air Service, Troy, New York.

WACO F-3: 225 Jacobs rebuilt at factory in May. Black rubbed finish, radio, instruments, lights, pants. Also Edo 2665 floats and new struts. Troy Air Service, Troy, New York.

WACO C CABIN 165: Wonderful condition. Just recovered and relicensed, $1,800. You buy the best from Pioneer Aviation Company, Airport, Syracuse, New York.

FOR SALE: 1935 model Waco custom cabin, Jacobs 225 engine; blind and night flying equipment, radio, wheel pants, Curtiss-Reed propeller and large gas tanks. This ship has special hand rubbed finish and has had less than 200 hours total time. It is just like a new airplane. Actually cruises 140 m.p.h. Bargain for cash. Troy Flying Service, Troy, Ohio.

LATE WACO CABIN: 210 Continental, 275 hours on motor. Standard instruments, plus bank and turn, steel propeller, rate of climb, radio, vermilion hand-rubbed finish, perfect condition throughout. $2,285. Inquire Stoner Manufacturing Corp., Aurora, Illinois.

WILL SELL WACO F: Warner powered. Standard instruments plus airspeed, bank and turn; perfect condition. $1,395. Inquire Stoner Manufacturing Corp., Aurora, Illinois.

WACO CABIN: 210 Continental. Heywood starter, bank and turn, rate of climb, less than 300 hours total time; excellent condition, priced for quick sale. Wings Field, Ambler, Pennsylvania.

WACO 10 GXE: Refinished red and silver. Licensed to November, 1936. Scintilla magneto. Extras. Bargain, $400. William Elias, R. D. 3, Moscow, Penna. Telephone: 181-R 11.

WACO 1935 CABIN: Jacobs motor, less than 50 hours; large tanks, pants, standard instruments, Y control column, extra safety belt. Consider Waco F in trade. Earl Ricks, Municipal Airport, Hot Springs, Arkansas.

WACO F: Warner 125 motor, completely overhauled 35 hours ago. Ship looks new. Bank and turn, Heywood starter, steel prop, other extras. $1,475. Frank Stroud, Municipal Airport, Hot Springs, Arkansas.

WACO RNF: Warner 125; licensed to April, 1937; 30 hours since major overhaul; air starter, cockpit cover, compass, rate of climb, bank and turn, clock, speed ring, navigation lights, high gloss finish. Price $1,750. Can finance. AERO DIGEST, Box 2313.

FOR SALE: 1935 model Waco standard cabin, Continental engine; ship exceptionally clean. Look it over and you will agree it is a real bargain for $3,150. Troy Flying Service, Troy, Ohio.

WACO CABIN: 34 model; powered by Jacobs 225 h.p. Majored and converted to '35 last fall. Extras; bank and turn, rate of climb, 70 gallon gas tanks. air brakes, thermometer, lights, flares; prepared for radio; steel propeller; special paint, finished in green fuselage and wings, trimmed in cream. Very attractive. Wonderful condition, $3,750. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

$450: WACO 10 OX-5: $450. Recently licensed. Fuselage recently recovered and done in Fokker red. wings yellow. Millerized; new carburetor. Excellent flying condition. Cash or terms. L. E. Pickard, Dansville, New York.

WACO CABIN: Late 1933; 210 Continental. Radio, landing lights, leather upholstery, extra gas tanks, metal propeller, flares, extra instruments, etc. 25 hours since major overhaul of ship and engine. Priced reasonably. Wm. Barclay Harding, Holmdel, New Jersey.

RECONDITIONED WACO 10: Reconditioned OX-motors. Airplane and engine repairs and overhauls at moderate prices. Nelson Flying Service, Wyckoff, New Jersey.

WACO CUSTOM CABIN 1935: Jacobs powered; lights, flares, rate of climb, bank and turn, radio, steel prop, wheel pants; excellent condition, priced right. Wings Field, Ambler, Pennsylvania.

FOR SALE: WACO cabin, 1933 model. Continental engine; only 150 hours since major overhaul and modernization. Blind flying equipment, radio, flares, large tanks, steel propeller, leather upholstering, air brakes, new tires, special paint job. Bargain for cash. Troy Flying Service, Troy, Ohio.

J-5 STRAIGHTWING: Licensed, excellent condition; 80 hours since majored; starter, metal prop, navigation and landing lights, bank and turn, rate of climb, thermocouple. W. Yearance, 52 Gramercy Park North, New York, N. Y.

LICENSED WACO 9: In excellent condition. $295 cash or will trade for light plane, C. E. May, Box 145, Minneapolis, Minnesota.

THREE 1935 WACO Custom Cabins: All have many extras. Visit Cleveland and see these jobs before you buy, if you are looking for real quality and value. The H. C. Robbins Company, Cleveland Airport, Cleveland, Ohio.

FOR SALE: 1934 Waco, with E type 250 Wright engine. Always owned by sportsman pilot and kept in best of condition. Complete equipment for night flying and blind flying, including radio. Bargain for cash. Ralph Johnson, Union Air Terminal, c/o Pacific Airmotive Hangar, Burbank, California.

WACO F, KINNER: Excellent condition. $1,375; $687.50 down. Will take trade. St. Louis Flying Service, Inc., Lambert Field, St. Louis, Missouri.

WARNER WACO: Heywood, steel, perfect, $1,500. Trade. Semi-air wheels, brakes, $35. Various tires. J-5, $275. Heywoods, parts. Want motors, airplanes and parts. Bird upper wings. Swedler Aircraft, 816 Ontario Street, Toledo, Ohio.

WACO 4-PLACE CABIN: Late 1934. 210 Continental. Total time 366 hours, 50 hours since major at Continental factory. Airplane like new; has every extra: flares, lights, big tanks, air brakes, bank and turn, radio, Morocco leather upholstery. $3,500. Austin Municipal Airport, Austin, Texas.

WACO F-2: Excellent condition. Color blue and yellow. Jacobs 170 recently factory majored. Plane just relicensed. Heywood starter, navigation and landing lights, flares, metal cockpit cover, wing root fairing, wheel pants; snappy performance. Price, $2,000. John Abiuso, Sunbury Airport, Sunbury, Pennsylvania.

WACO CABIN 1932: 210 Continental. Leather upholstery, radio, special instruments. 15 hours since engine majored. Take used car in trade. Colerain Auto Sales, 2710 Colerain Avenue, Cincinnati, Ohio.

WACO F, WARNER: Airplane and engine in excellent condition. $1,475; $737.50 down. St. Louis Flying Service, Inc., St. Louis, Missouri.

225 H.P. JACOBS WACO F-5: Completely equipped. 210 h.p. Continental Waco F-2, and Taylor Cub; all perfect condition. Many extras. Paul Peterson, 2503 Union Avenue, Altoona, Penna.

1935 CUSTOM CABIN WACO: 200 hours total time. Finished in special high gloss Waco vermilion. Has following equipment: Landing lights, flares, turn and bank, rate of climb, thermocouple, four-hand clock, Lear radio compass, pants, blind flying hood; bonded and shielded and completely equipped for transmitter. 25 amp. generator, new tires. Ship looks and flies like new. Price, $7,000. Waco Distributors, Inc., State Airport, Hillsgrove, Rhode Island.

WACO 10 GXE: 75 hours since completely reconditioned; fuselage finished in high-lustre blue; wings red. Engine 90 hours since new. Flottorp prop. Price, $425. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WACO F KINNER B-5: Five new heads; Heywood starter; black with red wings. Relicensed April; 450 hours. $1,625. Central Aeronautical Corporation, Municipal Airport, Indianapolis, Indiana.

FOR SALE: 1934 Waco cabin with modernized Continental R-670 engine. Extra equipment: complete radio transmitting and receiving set, flares, generator, bank and turn, sensitive altimeter, 75 gallon gas capacity, and special navigation lights with warning light. Color: blue with yellow wings. Finish and fabric in good condition. Price, $3,600. DuPont Airport, Wilmington, Delaware.

J-5 WACO STRAIGHTWING: Less engine and propeller. Total time since new, 80. No time since completely recovered and finished. Wings and fuselage Stearman vermilion, black stripe. New motor mount complete; new landing gear; brakes, wheels, tires and tubes; never cracked. Total time certified. Have the pleasure of owning the airplane, which is practically brand new. $1,050. John T. Corrodi, Inc., Box 185, Bexley Station. Columbus, Ohio.

STRAIGHTWING J6-5 WACO: Just relicensed; less than 100 hours since overhaul; engine ring, mail type windshield. Vermilion fuselage, cream wings. $1,100. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

Whittelsey

WHITTELSEY AVIAN: Cirrus motor in good shape; ship just refinished very attractive color. Wing slots and full air wheels. Very nice performing airplane. Will take car or ship on deal. H. B. Kaywood, 1013 First Street, Jackson, Michigan.

Miscellaneous Aircraft

Aeronca, American Eagle, Arrow, Beech, Bird, Buhl, Cessna, Command-Aire, Curtiss Jr., Robin, Thrush, Driggs, Eaglerock, Fairchild, Fleet, Great Lakes, Heath, Howard, Kellett Autogiro, Laird, Lambert, Lincoln Page, Lockheed, Moth, Pitcairn, Pitcairn Autogiro, Porterfield, Ryan, Simplex, States, Stinson, Straughan, Taylor, Travel Air, Waco.

1934 STINSON RELIANT: Licensed, like new, less than 200 hours; night flying equipment, radio, other extras, $5,775. Continental Waco F-2, licensed, perfect condition, night flying equipment, radio, other extras, $2,500. Kinner-powered Taylor Chummy in good condition, licensed, $750. Bargain. Continental Cub E-2 model, licensed, excellent condition, new September 1935, $1,200. Wright J-4 Waco straightwing, unlicensed, fair condition; make offer. Two OX-5 Command-Aires and other equipment. Write for details. Camel City Flying Service, Inc., Box 1941, Winston-Salem, North Carolina.

LICENSED AIRPLANES: $275 up. No doubt we have just what you want in cabin or open planes. Send stamp for list. Pioneer Aviation, Airport, Syracuse, New York.

STINSON SM8A: Lycoming, 900 hours total, 300 hours since major. High gloss finish, wings just recovered. $1,150. Taylor Cub: Continental A-40-3; 225 hours total; enclosure; $900. Al Slingerland, Airport, Melbourne, Florida.

STRAUGHAN: Identified, all new covering, $300 less prop. Travel Air 2000: Airwheels and Millerized, identified, can be licensed, $400. Mead Garage, Sterling, Kansas.

FOR SALE: Warner Fleet, Jacobs Cabin Waco, Warner Monocoupe, Lambert Monocoupe, Lockheed Air Express, Great Lakes, Stinson S, Taylor Cub, Warner 125 Fairchild 24, Warner 145 Fairchild 24. Aircraft Sales Co., Hangar D, Roosevelt Field, Mineola, New York.

REAL BARGAINS: Gipsy Moth, recovered, $6[illegible]0. Longwing Eaglerock, $225. Velie M-5, perfect, $125. Szekely 45 h.p., almost new, $150. Consider trades. Kidd, Box 195, San Antonio, Texas.

AERONCA LOW-WING: 70 h.p. LeBlond, flap, landing and navigation lights, total 100 hours; $2,500. 1933 Aeronca, $700. Pitcairn Autogiro with Kinner B-5, Heywood starter, steel prop, 2-place open, total 314 hours; left wing and rotor blades damaged beyond repair. Sell for $750 or parts separately. Tred Avon Flying Service, Inc., Easton, Maryland.

TAYLOR CUB: Excellent condition. Challenger Robin: Flares, landing, navigation lights. Aeronca, recently modernized. Warner Command-Aire: Airwheels, new type Warner. Kinner Fleet, blind flying instruments both cockpits. Curtiss Junior, others. Southern Aircraft Sales, 216 Milam Street, Shreveport, Louisiana.

WARNER CESSNA, Warner Stinson: Both perfect condition. Either sell or trade open job. Also sell Warner motor and propeller. Miki, 272 West Flagler Street, Miami, Florida.

REPOSSESSED A-40-3 CUB: Like new; $1,110, $200 down. 1935 Aeronca, late type; $1.200, $300 down. Buhl Pup, refinished; $500, $150 down. Pitcairn Kinner 125 h.p. Autogiro, like new; $1,500, $500 down. Balance easy monthly payments. Aviation Finance Company, Hemlock, New York.

STINSON RELIANT: Sperry horizon and gyro, Kollsman altimeter, turn and bank, rate of climb, night equipment, radio; total time 490, since major 35; price, $3,375. Bull Pup: Motor just majored, ship in excellent condition; price, $525. Walter C. Hartman, Bettis Airport, Dravosburg, Penna.

STATES SUPER MONOPLANE: Kinner 125, Hamilton steel propeller, oleo shocks, air wheels, brakes, interchangeable skid or tail wheel, navigation lights; total time, 102 hours. Excellent performance, perfect condition. Price, $1,500. Also Arrow Sport biplane, LeBlond 65, good condition; price, $525. Arthur Beaudoin, Fitchburg-Leominster Airport, Box 237, Leominster, Mass.

WACO CABIN 1933: Continental; 520 hours, 15 hours since majored. Hamilton prop, large tanks, radio, landing lights, flares, clock, turn and bank. Make reasonable offer. Waco Straightwing 165, J-6, 350 hours since new, 60 hours since modernized. Hamilton prop, starter, turn and bank, rate of climb, $1,500. Travel Air Sport K-16, Kinner 125, 225 hours since new. Electric starter, metal prop, many extras. Excellent throughout. Make reasonable offer. Kellett Autogiro, 210 Continental, total 540 hours, 60 hours since majored, on motor and overhead, $3,000. Red Bank Airport, Red Bank, N. J.

FAMOUS HOWARD RACER "IKE": Known throughout the country as a wonderful racing and stunting airplane. First class condition. Priced to sell. Harold Neumann, Geneseo, Illinois.

1935 225 H.P. JACOBS model Beechcraft Demonstrator: Perfect condition, new engine 100 hours, plane 300 hours. Late 1934 model Waco, 4-place, 225 h.p. Jacobs, total time engine and plane 284 hours; excellent condition. Late 1934 model Waco, 4-place, 215 h.p. Continental, total time plane 366 hours, engine 65 hours; excellent condition. Harry A. Hammill, Austin Municipal Airport, Austin, Texas.

KINNER MONOSPORT: $950. Hisso Eaglerock, brakes, $450. Hisso Ryan 3POLM, steel prop, $250. Lincoln Page, 250 hours, $450. Airwheels, 700 x 4, new, blade design 1827, $10. Want lower right Eaglerock A-2 wing. G. Imm, Fergus Falls, Minnesota.

SALE OR EXCHANGE: 14 certified airplanes. J-5 Travel Air. J-6 B-5 Ryan cabin ship, airwheels. J6-9 330 h.p. Travel Air cabin ship, airwheels. 2 Type 2000 OX-5 Travel Air's. 1 OX-5 Laird. 1 B-5 125 h.p. Waco, air starter. Continental A-40 powered Heath. 2 J6-7 and J6-9 Pitcairns, with or without motors, many extras. 2 OX-5 Waco 90's. 1 J-5 B-1 Ryan 5-place cabin ship. 1 Rover powered Driggs Trainer. 1 J6-9 Stinson, airwheels. Late model cars taken on deals. Terms to responsible buyers. Becker-Forner Flying Service, Inc., Jackson, Mich.

CHALLENGER COMMAND-AIRE: Motor just majored, ship refinished. B-6000 Travel Air just relicensed and motor majored. Licensed to carry seven. Mead primary glider, cheap. Geo. Sauter, 400 Union Street, Joliet, Illinois.

J-5 STINSON: 6-place. Like new. International orange, blue trim. J-5 Laird: Yellow with black trim, completely refinished. Buhl Pup: Refinished, wheel pants, many other extras. Indiana Air Service, Airport, South Bend, Indiana.

TRAVEL AIR J6-5: $1,275. Aeronca C-3, $800. Taylor Cub, $850. All licensed and in perfect condition. Cincinnati Aircraft Service, Lunken Airport, Cincinnati, Ohio.

1935 TAYLOR CUB DEMONSTRATOR: $1,325. Avro Avian, $565. Challenger motor; Wasp motor. Also Velie motor. Robin right wing, tail group. AERO DIGEST, Box 2324.

11 CERTIFIED RECONDITIONED Airplanes: Priced to sell. Two J6-9 Stinson six-place cabins. Three J-5 Travel Airs. J-5 Straightwing Waco. Driggs Skylark, Rover powered. Two OX Travel Airs, stressed for J-5's. Two OX-5 Eaglerocks, one stressed for J-5. Trade in your ship or late model car. Terms if desirable. Write for details. Central Air Service, Grand Rapids, Michigan.

FOR SALE: 1935 Taylor Cub, late A-40-3 type motor, ship and motor less than 100 hours, guarantee perfect; always privately owned, $925. Also: 1936 Cub Demonstrator, 40 days old, new plane and motor guarantee, $175 off. J-5 Stinson, new upholstery, covering good, 10 hours on motor since completely majored, $1,150. Detailed information upon request. Southern Air Services, Inc., Municipal Airport, Memphis, Tennessee.

JACOBS WACO: 5-place custom; fully equipped, including two-way radio and ambulance stretcher; never damaged. Selling to replace with new model. J-5 Taperwing Waco: Excellent condition. B-5 4-place Bird: Recovered, hand rubbed finish, engine just majored; equipped blind, radio, night flying. Akron Airways, Akron, Ohio.

BEST BUYS ON PAGE: Less motors. B-1 5-place Ryan cabin ship, full airwheels, $550 less motor. J6-9 6-place Travel Air cabin ship. 1 J6-7 250 h.p. Pitcairn, loaded with instruments. These ships all NC licensed and priced to sell. Michigan Aero Motors, Jackson, Michigan.

FOR SALE: Airplanes, motors, supplies. Curtiss Wright Jr., 2-place, pusher monoplane, slightly used, regularly $1,570; our price, only $750. American Eagle 3-place biplane, only 160 hours total, OX-5 motored; bargain, $450. American Eagle 3-place, total 200 hours, not licensed; newly covered excepting fuselage has original covering; snap, $375. OX-5 90 h.p. engine, 50 hours total, nice condition, $115. OX-5 engine, modest total time, completely overhauled, excellent, $75. OXX-6 100 h.p. engine, 50 hours total, nice condition, $140. OXX-6 engine, 100 hours total, then Navy completely overhauled; dandy, $115. Elliott cross-level bubble type bank or climb indicator, $2. Elgin ball bank indicator with luminous dial, regularly $7.50; our price, $5.75. Pilot's black leather log book with detachable insert, $1; postage 5c. Send for Catalog R on OX-5, OXX-6, Hispano, Liberty parts; or Catalog 18 on all aviation supplies. Logan Aviation Co., 716 West Superior, Cleveland, Ohio.

ENGINES

Anzani, Cirrus, Curtiss, Kinner, LeBlond, Lycoming, Pratt & Whitney, Velie, Warner, Wright

FOR SALE: Lycoming R-680; needs top overhaul. First offer over $175 takes it. Goodwill Air Service. Madeira Airport, Bernharts, P.O., Reading, Penna.

CURTISS C-6 MOTOR: Scintilla magnetos, 85 hours since major. Cheap, $75 cash. Also Curtiss-Reed pusher prop for same, $10. AERO DIGEST, Box 2315.

OVERHAULED OX-5's, $35 up. 120 h.p. Anzani radial, $65. Curtiss Jenny, less motor, $65. Curtiss M.F. flying boat, less wings, $50. C. R. Barry, Portsmouth, Ohio.

ENGLISH CIRRUS III: 3 only used 250 hours. Brand new heads, valves. $260. Also have new cases, shafts, manifolds, pistons, etc. Inman, 3770 Boise Avenue, Venice, California.

J6-7E: Serial No. 13855, no time since top overhaul by Wright station. Complete and reasonably priced. B-5 Kinner: 265 hours total, none since major, $350. Warner 125: 575 hours total, one since major, $450. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Pennsylvania.

WRIGHT J-5, J6-5-7-9, Wasp B-C-C1-S1D1: Completely overhauled by approved repair station. Export airworthiness certificate supplied. Full details and price on request. Parts: Wasp B cylinders, brand new; also J-5, J-6 cylinders, pistons, master rods, articulated rods, etc., new and used. Practically any part for Wright and Pratt & Whitney engines. C. M. Ewan & Co., 210 West 55th Street, New York, N. Y.

LYCOMING MOTOR R-680: Modernized. Guarantee no time since complete major by airlines. "C" shaft, forged pistons, electric starter, shielded, boxed. $495. Al Leeward, New Kensington, Pa.

ENGLISH CIRRUS MARK III: Completely rebuilt, and parts for same. Curtiss OXX-6 in like new condition. Avro-Avian parts and fittings. Lester J. Sipe, Box 118, York, Penna.

1935 WRIGHT WHIRLWIND J6-7: 75 hours total certified time. Location: Wright factory, disassembled for inspection. Factory guarantee. A new engine at a large saving. AERO DIGEST, Box 2322.

REBUILT OX-5 MOTOR: $55. Velie M-5, rebuilt, like new, $150. Dayton Bear, 4-cylinder, air-cooled; 12 hours; Hartzell prop; $125. Pair 30 x 13 x 6 Goodyear balloon hubs, with brakes, $25. J-5 Lockheed Vega parts. Ryan B-1 fuselage, J-5 mount. $25. Complete blueprints for Great Lakes gas tank, late type, new. $5. Watson Airport, Youngstown, Ohio.

AMERICAN CIRRUS ENGINE: Complete, less upper case; excellent condition. 150 hours since overhaul. $125. OX Waco landing gear complete. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

ENGLISH CIRRUS, MARK III: 95 h.p. engine, brand new, complete in original crate as shipped from factory, $275. N. W. Perdew, Hasbrouck Heights, New Jersey.

CHALLENGER, Continental 210 and 165 motors. Cirrus parts. Kellett autogiro parts. Fledgling parts. J6-5 or -7 motor mount, new, for Travel Air. Instruments. F & G Engine Co., Roosevelt Field, Mineola, New York.

125 WARNER with shielded plugs, harness and mags; no time since thorough major. Best offer over $400 takes it. AERO DIGEST, Box 2331.

WANTED TO BUY OR TRADE

WANTED: Both landing gear struts and both left wing struts for J6-5 Aristocrat. State price, whether new or used, in first letter. Bert Massey, Duncan, Oklahoma.

WANTED: All or any part of Edo float equipment model 2425 for Fairchild "24" C-8-C. State condition, price ready for shipment. Portland Air Service, Inc., Portland Airport, Portland, Oregon.

LOOKING FOR BARGAIN in Aeronca, Taylor Cub or similar ship. Give full details and price in first letter. John C. Powel, Crossville, Tennessee.

WANTED: Good condition, English Gipsy III, or Major, engine. State hours done, price, packed and delivered steamer New York. Cormack, Gresham Hotel, Dublin, Ireland.

WANTED: Spars and ribs for Fleet Model No. 1. C. E. Lemire, Box 525, Orlando, Florida.

$225 CASH for Szekely Pup, Velie or similar, or OX-5 Waco, Eaglerock, or similar ship. J. Murray, 139 Concord, El Segundo, California.

WANTED FOR CASH: Kinner Fleet or Kinner Waco F; must be in good condition and priced right. All particulars first letter. AERO DIGEST, Box 2316.

WANTED: Warner motor or equivalent; 110 or 125 h.p. Complete details and cash price first letter. W. L. Chamberlain, East 8th Street, Rochester, Ind.

I WANT THE BEST 150 h.p. motor I can get in exchange for any of these items: new Zeiss binoculars, suburban houses, lots, white oak lumber, outboard motors, row boats, second-hand libraries, standard steel shapes, office equipment or tractors. No foreign motors considered. W. B. Pitkin, Dover, New Jersey.

WANTED: Two place light ship to build up time. Prefer one in flying condition but will consider a crack-up or one needing repair. Must be priced right for cash. S. B. Mathieu, 5330 Dallas Avenue, Fort Worth, Texas.

PIONEER OFFERS reliable service to plane owners. If you want to sell for cash, write or wire us. Quick action, results assured. Pioneer Aviation, Airport, Syracuse, New York.

WANTED: EDO floats for Travel Air 4000-E. Will pay cash. State price and condition in first letter. Stuart Galbraith, 86 Williams, Pontiac, Michigan.

WANTED: Licensed OX Bird in A-1 shape. State history and rock-bottom price for cash. Write Walter Wahlin, 533 West Main Street, Titusville, Pa.

WANTED: Kinner Bird. Trade or cash. Have Kinner Eaglerock, good condition. Steffen Aeronautical Service, Buffalo Airport, Buffalo, New York.

TRADE: 1935 De Luxe Oldsmobile convertible coupe, radio, etc., value $750, for a one- or two-place fast monoplane. John Fernsler, Jr., 145 Crestmont Terrace, Collingswood, New Jersey.

WANTED IMMEDIATELY: Waco F left gas tank, good; 700 x 4 casing; Warner engine; J-5 main case or parts. Dycer Airport, 9401 Western, Los Angeles, California.

SPOT CASH PAID for your airplane, motors, or parts. Give full information in first letter. Glenn W. Fellows, P. O. Box 66, Jackson, Michigan.

CASH PAID for Wright and Pratt & Whitney engines and parts; also all accessories, any quantity, any condition. C. M. Ewan & Co., 210 West 55th Street, New York, N. Y.

WANTED: American Cirrus motor, Upright, new or slightly used if well within factory clearance limits. T. Davis, 3402 Park Avenue, Richmond, Virginia.

WANTED: Aeronca engine, E-107-A, or crankcase for same; or E-113 engine. T. E. Wages, Union City, Georgia.

WANTED: Wright J-6 engines or parts, any series. Also Pratt-Whitney engines and parts, any series. We also buy propellers, instruments, air wheels. Babb, 1100 Airway, Glendale, California.

WANTED: Fokker Standard and Super Universals, 71 Fairchilds, pontoons and chassis, skiis, J6-9 and Wasp motors, Stinson trimotors, parts for above. Also damaged pontoons, etc. AERO DIGEST, Box 2319.

CLASSIFIED CLOSING DATE FOR JULY—
JUNE 18

WANTED

WANTED: Great Lakes in good condition; also, J-5 or J6-7 engine and prop; also, complete engine cowling and oil tank for Waco Straightwing BSO. John T. Corrodi, Inc., Box 185, Bexley Station, Columbus, Ohio.

WANTED FOR CASH: Airplanes and motors in any condition; air wheels and instruments. Parts for Wright Morehouse motor. Give details and price in first letter. Floyd Becker, Aberdeen Road, S. E., Grand Rapids, Michigan.

WANTED: Amphibion or plane licensed on floats. Will trade paying property, 7 room cottage house. Modern conveniences, double garage. On corner lot in desirable location, 12 miles from beaches. For sale: OXX-6 Waco, just licensed, in good condition. $385. Malcolm Hardy, 13 Legrande Avenue, Tarrytown, New York.

WANTED: Wings for 1933 Aeronca C-3. Preferably uncovered, in good condition. Give details and price in first letter. AERO DIGEST, Box 2328.

WANTED: Kinner Fleet or Bird. One needing overhaul preferred. Will pay cash. A. G. Becker, Pittsburgh-Bettis Airport, Dravosburg, Pennsylvania.

CASH: For your airplanes in any condition. Want J-5 and J-6 motors, parts and propellers. Write details in first letter. J. E. Poisson, 1219 Penn Avenue, Grand Rapids, Michigan.

MISCELLANEOUS PRODUCTS AND EQUIPMENT

DON'T BUY ANYTHING until you get Ort's 1936 Aviation Material Catalog. Prices are lower. Send thin dime today. (Canada 20c.) Karl Ort, 624 W. Poplar, York, Pennsylvania.

CLOSING OUT: J-5 and J-6 parts; Wasp and Cyclone parts; overhaul tools for Wright and Lycoming; AN bolts; spark plugs, instruments, etc. Write for list. Pontiac Aircraft Company, Pontiac, Mich.

AERONCA PARTS: Two used ailerons; used prop for C-3 motor. Used carburetor; set of used 700 x 4 tires and tubes. Also Heath B-4 motor. AERO DIGEST, Box 2318.

NEW HAMILTON Steel speed prop, for Mark III American Cirrus. Hamilton steel prop for Lambert 90 h.p., just etched. Priced to sell. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

ONE NEW, RIGHT Robin wing, complete with gas tank, in original crate; color, Robin orange. Will sell for best offer. Serv-Air, Inc., Raleigh Municipal Airport, Raleigh, North Carolina.

OVERHAULED SPERRY Horizons: $160. Frank Ambrose, Inc., Municipal Airport No. 2, Jackson Heights, New York.

PORTABLE HANGARS: Something new and practical. The answer to low cost storage. $9.59 monthly pays for it. No down payment. Bennett Air Service, National Distributor, Hightstown, New Jersey.

850 x 10 new approved wheels with brakes. 1100 x 12 Goodrich tires, at big discount. Write for your requirements. Sun Batteries, 10521 Gratiot, Detroit, Michigan.

WARNER 125 H. P. Hamilton propeller, reconditioned. $100. Excellent pair 6.50 x 10 semi-airwheels, complete with brakes, tires and tubes, $65. Eclipse electric starters for Lycoming, Jacobs, J-5, etc., $75; hand inertia for same, $20. New 15v-15a generators with control boxes, $40. Basil Aviation Co., Philadelphia Municipal Airport, Philadelphia, Penna.

AERIAL ADVERTISING Banner: A-1 shape, 6′ x 60′. Includes release, rope, spreader bars, etc. $50. (Special release for Aeronca, $5 extra). Al Leeward, New Kensington, Penna.

ARTIFICIAL HORIZON, directional gyro, sensitive altimeter, bank and turn, rate of climb, induction compass, manifold pressure gauge, and other instruments, just overhauled at factory. Reasonable. AERO DIGEST, Box 2321.

WESTPORT REMOTE CONTROL radio with dynamotor B, $50. Exide aircraft battery, good condition, $15. Ignition shielding complete, for Continental 210, $15. G. H. Dusman, York, Penna.

AMERICAN CIRRUS engine parts, new. Special camshaft with roller followers for Inverted Cirrus. 6.50 x 10 wheels and brakes, new. Type P. C. V. Aerol struts. Write for information. R. J. Ebbert, P. O. Box 3, Drayton Plains, Michigan.

PROPELLERS: Hamilton Standard, reconditioned in our Government Approved Station: J-5, $65; J-6, $70; Lycoming, $85; J-5 hubs, $20; J-6 hubs, $25; three-way hubs for test purposes, $15. Carburetors, J6-9, reconditioned, $35. Magnetos, J-5 or Wasp, overhauled, $20. Cylinders, J-5, $15. Starters, Series 6 or 16, hand inertia, $20. General Airmotive Corporation, Municipal Airport, Cleveland, Ohio.

CHALLENGER PISTONS, rings and pins. Kinner Fleet cowls, stabilizers, flipper and gas tanks. Fledgling cowls. Travel Air parts. Irving pongee chute. Standard Hamilton props for J-5 and Lycoming. Lewis Holy Name School of Aeronautics, Lockport, Illinois.

HAMILTON STANDARD steel propeller: Fits Continental, Lycoming and Wright engines. Excellent condition; will sell for $85. John Abluso, Sunbury Airport, Sunhury, Pennsylvania.

WARNER INDUCTION HOUSING: $37. J6-9 crankshaft, $70. Kinner and Warner valve guides, intake, 90c. Exhaust, $1. Write for your new 1936 catalog. Snyder Aircraft Company, Municipal Airport, Chicago, Illinois.

BRAND NEW serviceable Hornet pistons, usable for ornaments or ash trays; weigh 4½ pounds; $1.40 each. Silk flare parachutes, $2.50 each. 24 x 4, 26 x 5, 26 x 3, 28 x 4 new nonskid straight side tires, $2.50 each; tubes, $1. AC and Champion spark plugs, 20c each. New 13 volt, 30 ampere generators, with voltage regulator, $6 each. Irvin parachutes with seat packs, $65 each. 20 x 4 drop center wheels, $3.50; 14 x 3, $2.25. Crawford Airplane Supply Company, 350 Washington Boulevard, Venice, California.

STANDARD STEEL propellers, any size, $75; wood props, $15. Radial mounts for converting OX Robin, Waco, Travel Air. Vees, wings: Travel Air, American Eagle, Swallow, Command-Aire, Eaglerock. Oleos. Dope, 80c gal. Geared 180-220 Hisso. J-5. Kinner B-5. Miller Flying Service, Montclair, New Jersey.

WILEY FLARES: Factory reconditioned. Limited number at $22.50 each. Aviation Associates, Inc., Curtiss Airport, East St. Louis, Illinois.

MISCELLANEOUS SERVICES OPPORTUNITIES, OFFERS, ETC.

WORLD'S GREATEST AIR CIRCUS in process of organization! Pilots suspended or revoked, airworthy unlicensed aircraft owners—communicate with Air Pilots Associated Press, Welsh, Louisiana, now.

AN AVIATION MECHANICS' School approved by the Dept. of Commerce. Entering age, 16-25 years. Your work earns your tuition. Apply or write: Capt. Sansom Aviation School, 157 Charter Oak Avenue, Hartford, Connecticut.

AIRPORT OPERATORS: Being distributors, we have new Taylor Cubs and Rearwin Sportsters on hand. Will gladly demonstrate to your customers. Wire or phone for quick service. Dealers wanted. Bennett Air Service, Hightstown, New Jersey.

FLY IN NEW Taylor Cub: $5 per month dues; $6 dual hour, $4 solo hour. Instruction by transport pilots. Airport convenient to all subways. J. W. Johnson, 63-51 Booth Street, Rego Park, Long Island, New York.

LEARN TO FLY: White Flying Service, Inc. Special Solo Course, $50. Flying time available in new Taylor Cubs, Fleet Sport Trainer, Fairchild Cabin and Stinson planes. Caldwell-Wright Airport, Caldwell, New Jersey. Phone: Caldwell 6-1560.

TRANSPORT COURSE: $1,080; L.C. or Private, $290; flying new planes. Including training in business management, aviation sales, etc. Free booklet. Bennett Air Service, Hightstown, New Jersey.

FORCED TO OPERATE repair stations for our own crashes throughout the country, to keep our mechanics occupied we solicit repairs on your crashed ship, allowing you to fly away. No down payment, financing repairs over twelve months. Aviation Finance Co., Hemlock, N. Y.

AN EDUCATIONAL opportunity in aeronautics; one of America's foremost manufacturers of airplanes for civil use will absorb in its organization a small number of young men with at least two years of college education. Modest salaries exceeding dormitory expense will be paid to qualifying young men. Reasonably priced tutoring in aeronautical design and engineering, sales engineering, production, tool making, and accounting methods will accompany practical shop experience. State college qualifications or practical experience in request for further information. Address replies to: AERO DIGEST, Box 2330.

WANT PARTNER or parties to finance an airplane sales and service, both new and used, in connection with an airplane repair station now operating in Ohio. AERO DIGEST, Box 2320.

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Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making any necessary repairs and adjustments. Particularly important is the detailed information on locating causes of engine troubles. The book is lavishly illustrated; photographs, diagrams, and working drawings make it easy for you to follow each explanation. 400 questions enable you to test your understanding of each subject treated.

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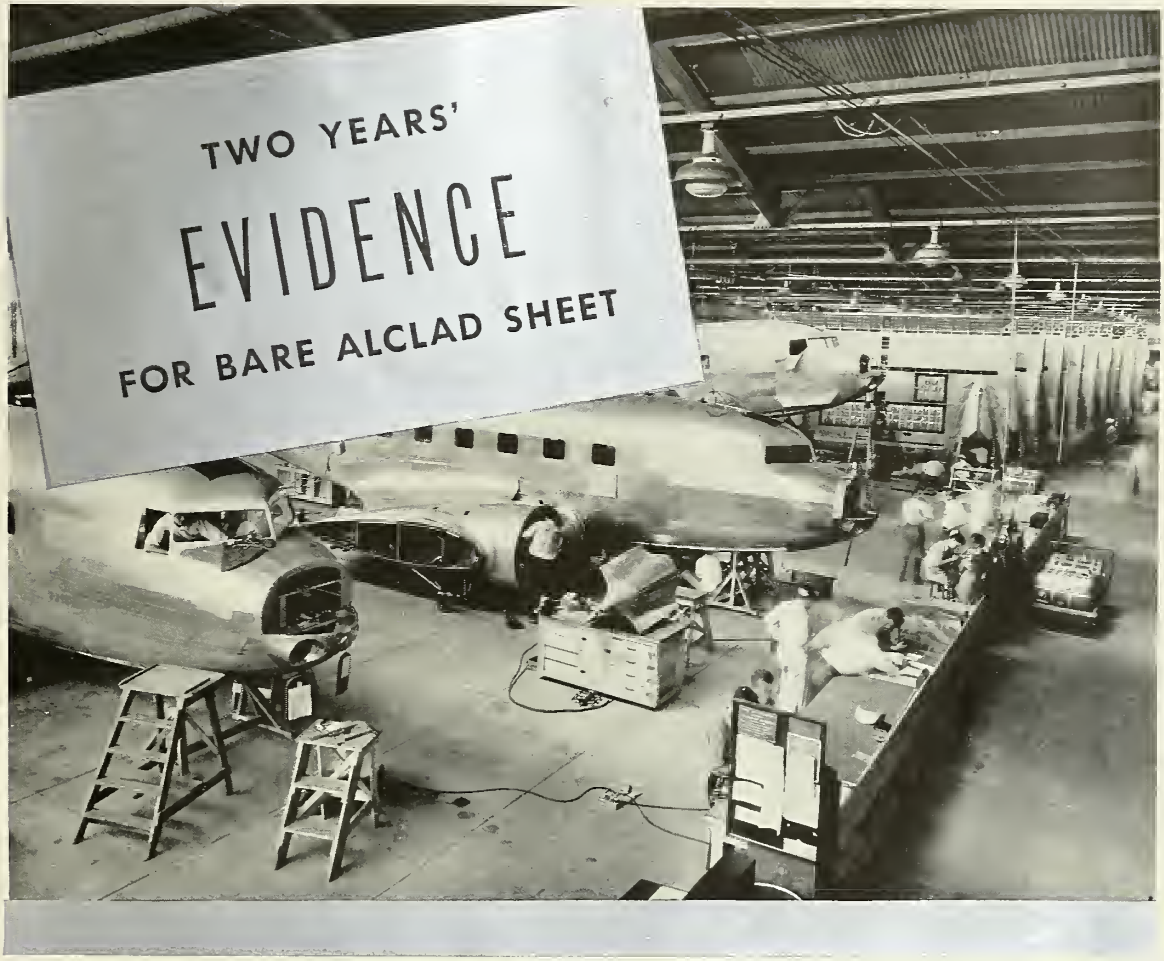

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